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Transactions of the Woolhope Naturalists' Field Club

Woolhope Naturalists' Field Club, Hereford, England, G. H. Jack

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Appendix

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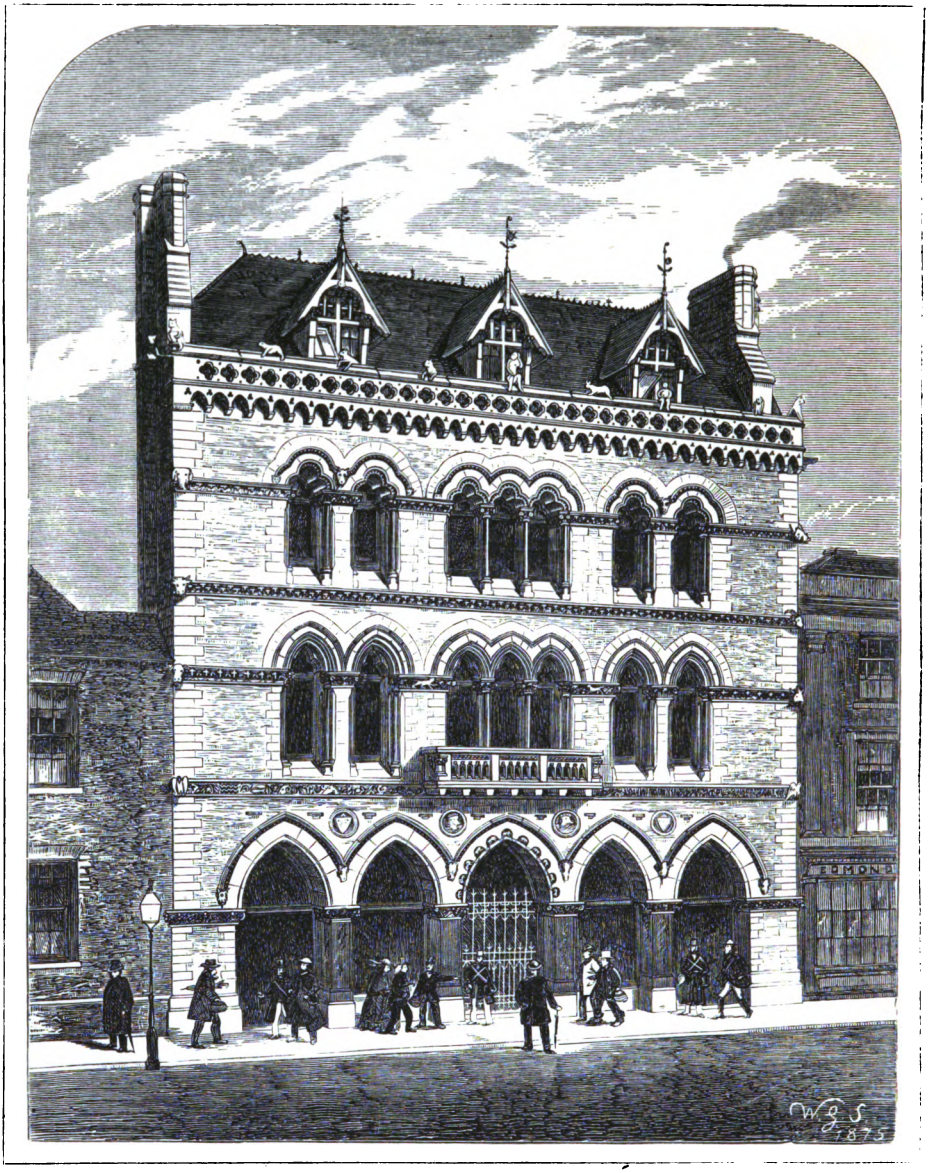

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TRANSACTIONS

OF THE

WOOLHOPE

NATURALISTS' FIELD CLUB

(ESTABLISHED MDCCCLI.)

1874-5-6.

"HOPE ON—HOPE EVER."

HEREFORD : 1880.
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TRANSACTIONS FOR THE YEARS 1874-5-6.

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LIST OF NEW MEMBERS.

HONORARY MEMBERS.

ELECTED 1874.

Rev. M. J. Berkeley.
C. E. Broome, Esq.
Rev. Wm. Houghton.
Wm. Phillips, Esq.
C. B. Plowright, Esq.
James Renny, Esq.

ELECTED 1875.

Rev. Wm. Bevan.
Rev. T. W. Webb.

ELECTED 1876.

M. C. Cooke, Esq., M.A.
Rev. J. E. Vize.
The President and Secretary of the Cardiff Naturalists' Field Club.

ORDINARY MEMBERS.

ELECTED 1875.

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Joseph A. Bradney, Esq.
Rev. J. Duncan.
T. S. H. Hincks, Esq.
J. W. Lukes, Esq.
Rev. G. M. Metcalfe
W. Watkin Old, Esq.
Wm. Phillips, Esq.
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Richard Rees, Esq.
John Riley, Esq.
Stephen Robinson, Esq.
Lewis Sargeant, Esq.
Rev. F. C. Stebbing.
Richard Thomason, Esq.
Stephen Vernon, Esq.
R. F. Woollatt, Esq.
Rev. Wm. Wyatt.
Rev. Arthur Young.

ELECTED 1876.

Captain Doughty.
Rev. John Goss.
Rev. C. E. Maddison Green.
Rev. Thomas P. Powell.
Captain Mayne Reid.

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LIST OF MEMBERS,

FEBRUARY, 1877.

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1851	George Bentham, Esq.
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,,	R. M. Lingwood, Esq.
,,	Rev. W. H. Purchas.
,,	Rev. W. S. Symonds, F.G.S.
,,	Rev. R. H. Hill.
1853	W. H. Fitton, Esq., M.D., F.R.S., F.G.S., &c.
1854	Sir W. V. Guise, Bart., F.G.S., &c.
1855	G. Phillips Bevan, Esq., F.G.S.
1859	Professor W. Melville.
1860	Dr. H. B. Geitnitz.
1861	Edwin Lees, Esq., F.L.S., F.G.S.
1865	W. H. Paine, Esq.
1869	W. G. Smith, Esq.
,,	Mr. With.
1874	Rev. M. J. Berkeley.
,,	C. E. Broome, Esq.
,,	Rev. Wm. Houghton.
,,	Wm. Phillips, Esq.
,,	C. B. Plowright, Esq.
,,	James Renny, Esq.
1875	Rev. W. L. Bevan.
,,	Rev. T. W. Webb.
1876	M. C. Cooke, Esq.
,,	Rev. J. E. Vize.

The Presidents and Hon. Secretaries of the following Field Clubs :—Caradoc, Oswestry and Welshpool, Severn Valley, Warwickshire, Worcestershire, Cardiff, Dudley and Midland, and the Curator of the last-named Club.

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FEBRUARY 1877.

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Allen, B. Haigh, Esq.
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Apperley, H. G., Esq.
Arkwright, J. H., Esq.
Armitage, Arthur, Esq.
Banks, G. V., Esq.
Banks, R. W., Esq.
Bateman, The Right Hon. Lord
Bevan, Rev. T. M.
Berrington, Arthur D., Esq.
Blashill, Thomas, Esq.
Bodenham, C. De la Barre, Esq.
Bodenham, Frederick, Esq.
Bosanquet, S. R., Esq.
Bradney, Joseph A., Esq.
Broughton, F., Esq.
Bull, H. G., Esq., M.D.
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Cam, Thomas, Esq.
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Carless, Joseph, jun., Esq.
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Cocking, George, Esq.
Cobbold, Rev. R. H.
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Davies, James Henry, Esq.
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Fowler, J. T. Owen, Esq.
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Goss, Rev. John
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Jones, Gray T., Esq.
Jones-Machen, Rev. J. Edward, M.A.
Jones-Thomas, Rev. W., M.A.
Jones; Dr. Talfourd
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Lambe, John, Esq.
Lawrence, David, Esq.
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Lane, Theophilus, Esq.
Lukes, L. W., Esq.
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Lloyd, John, Esq.
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Pateshall, Evan, Esq.
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Phillips, Wm., Esq.
Phillips, Edward Cambridge, Esq.
Phillott, Rev. H. W., M.A.
Piper, George Henry, Esq.
Poole, Rev. Wm., M.A.
Powell, Rev. T. Prosser
Price, William, Esq.
Prickard, Rev. W. E.
Purchas, Alfred, Esq.
Rankin, James. Esq.
Rees, Richard, Esq.

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Robinson, Stephen, Esq.
Rosher, Lilburn, Esq.
Salwey, Alfred, Esq.
Salwey, Humphrey, Esq.
Sandford, Dr., H. V.
Sargeant, Lewis, Esq.
Scobell, E. C., Esq.
Severn, John Percy, Esq.
Shellard, Orlando, Esq.
Smith, R. Vassar, Esq.
Smith, Rev. T. Thwistlewaite, M.A.
Southall, Henry, Esq.
Stanhope, Rev. Berkeley L. S., M.A,
Stanhope, Rev. Wm. P. S., M.A.
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Vernon, S., Esq.
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West, H. W., Esq.
Westropp, Rev. C. J., M.A.
Williams, E. Colt, Esq.
Williams, Rev. R. H., B.A.
Wood, H. H., Esq.
Wood, J. H., Esq.
Woollett, R. F., Esq.
Wyatt, Rev. Wm.
Wynn, N. S., Esq.
Young, Rev. Arthur

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Woolhope Naturalists' Field Club.

MEETING AT CHURCH STRETTON,

FRIDAY, MAY 15TH, 1874.

The first Field Meeting for the season of the Woolhope Naturalists' Field Club was held at Church Stretton on Friday, the principal object being an excursion on foot to the summit of the lofty hill on the N.E. side of that town, known as Caer Caradoc. An alternative excursion for those members who did not care to encounter the fatigues of the ascent was arranged, the party ascending the Longmynd hills, along the basis of which Church Stretton is situated. Very few, however, availed themselves of the alternative, nearly the whole of the party preferring to test the truth of the poetic adage, although destitute of the inducement which he describes as justifying the effort:

> How hard it is, and difficult to climb
> The steep where Fame's proud temple shines afar—

The only "fame" with which the gray summit of Caradoc is associated being the legendary renown of the British hero-king, whose actual presence on the spot at any time is a matter of pure conjecture.

The Meeting was fairly attended. The party from Hereford started from that city by train at 9.30, and were joined at Leominster by the President (Rev. James Davies, of Moorcourt) and a small party; and at Ludlow by Mr. T. Salwey and friends. On reaching Church Stretton at 11 a.m., the President and Members were greeted by the Rev. Donald Carr, of Woolstaston, and the Rev. William Elliott, of Cardington, who had kindly undertaken to act as guides. Leaving behind the few who had preferred the Longmynd, the rest of the party (22 in number) made their way along the foot-path which skirts the base of the the Lawley Hill into the sloping pass between it and Caer Caradoc, and then commenced the ascent of the latter hill. The air, even in the valley, was cold and ungenial—more like that of March than the "Merry May" of the poets—but the labour of climbing the ascent made most of the philosophers quite warm enough, when they reached the summit, to feel the cold northerly winds at first rather agreeable. The occasional bursts of hot sunshine seemed to have no perceptible effect in warming the air, the delicious purity of which was not more

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remarkable than its penetrating coldness. On their way up, the botanists of the party noticed on every hand the effects of the late frosts upon the vegetation. In the pass, frost-bitten cowslips were gathered, and on the ridge the sward was parched and the culms of the short grass were blanched and dead. Even the hardy bilberry (Vaccinium myrtillus) had its young leaves nipped into a browner shade than usual, and its growth stunted to little more than half its usual height, except indeed in the few places where the plant was sheltered by the bosses of black rock. The rock bedstraw (Galium saxatile) which ought at this season to have covered the surface with its delicate white flowers, was visible only to a close search; and the only wild flowers which seemed wholly unaffected were the pretty mountain pansy (Viola lutea), the bright yellow lip of which adorned the sward wherever there was half an inch of soil to afford it foothold, and stunted specimens of the dog-violet (Viola canina).

To the Archæologists of the party, the caer, *i.e.* camp, was an object of interest, as apparently one of the rudest and simplest specimens of ancient castramentation in the district. The whole of the summit is included, but there is very little of human handiwork. The excavation—there was no construction—could not have taken long, even with the rude tools and unskilled labour of Caradoc's time, 1800 years ago. A trench was cut right across the ridge just below the peak connecting the natural crags and precipitous sides of the hill, a hollow was excavated on the opposite side of the peak; and the rest of the defence was left to the stout arms of the garrison. The only supply of water was a scanty spring on the N. side, now dried up. The position was therefore untenable for any considerable body of men, and as the approach along the ridge is easy, its defenders must have succumbed to a single assault by a Roman force. How such a position could ever have been mistaken for the scene of Caractacus's last encounter must remain a mystery. In no one particular does it bear out Tacitus's very clear and remarkable description.

To the tourist, the scene is altogether beautiful, the only deficiency in the view being the want of water. Unfortunately the sky on Friday was covered with a cold gray haze, through which the Wrekin and the Stiperstones were but dimly visible, but the near view was charming. The long broad range of the Longmynd, cleft with so many beautiful glens, the rich vale, the pretty town of Church Stretton, with its ancient church, nestling amid bright green foliage, the noble masses of the Lawley, the Raglet, the Brown Clee, and Titterstone stretching far away in the dim perspective to the south, all made up a *sylvis scena coruscis* well worth the trouble of the ascent.

The geologic section of the party was unusually small in number, but those who were present could not help regarding with interest the highly suggestive view. On the east, the eye looked down the scale of ages, across the vast period of the Mountain Limestone and Coal strata to the New Red Sandstone which dimly appeared in the distance. Looking westward across the broad valley which marks what a distinguished honorary member of the Club—the Rev. W. Symonds, in his "Records of the Rocks"—has described as "a tremendous fault," the observer's eye rests upon one of the very lowest and earliest of the sedimentary

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rocks, the Clay Slate or Cambrian Rocks. The whole of the Silurian rocks, which are elsewhere sixty miles in breadth—say from Malvern to Llandovery—are here crushed into a valley half-a-mile broad. Caer Caradoc itself consists of Caradoc Sandstone traversed and altered by basalt, which forms the peak; and it is apparently the N.W. end of a chain of similar upheavals, beginning with Titterstone. The altered sandstone lies upon the basalt on the N.W. side, and in the decent of the hill the visitor comes upon other Silurian rocks which overlie the Caradoc Sandstone. "At Botville, on the N.W. flank of Caer Caradoc," says Mr. Symonds, "there is a mass of Wenlock Limestone jammed between the Longmynd rocks and the Caradoc Sandstone, a proof that considerable earthquake movements have affected the whole country since the deposition of the Upper Silurians." The Rev. Wm. Elliot kindly offered to guide the company to an instructive section of Aymestrey Limestone, containing in abundance the characteristic Pentamerus Knightii; but the members were so fatigued with their decent of the Caer (1,200 feet) that they preferred to leave the limestone with its fossils as Wordsworth left Yarrow:

Whate'er betide, we'll turn aside,
Nor view the braes of Yarrow.

Having decended from the hill at its steep N.W. side, the members made their way to Church Stretton.

In the interval before dinner, the party visited the church, where they were courteously received by the Rev. H. O. Wilson, the rector, who conducted them round it. The edifice has been very carefully restored, but it still retains two features of interest. The south porch, which has been converted into a vestry, appears to have been a fine open structure of the 14th century, of a type once common in the district, but now preserved only at Credenhill and a few other churches in Herefordshire. The doorway is most interesting, being a good specimen of Norman work: on the eastern side the capital is entirely gone, having been constructed of a tufaceous sandstone; but the arch and the western jamb, with sunk column and projecting volute capital are in perfect preservation. The north doorway is remarkable on the exterior for a rude carving of a figure with arms akimbo, much defaced, the design of which is open to conjecture. The style of execution is very rude, and indicates a rustic artist as well as a very early period.

The members met at the Church Stretton Hotel at 4.30 p.m., and partook of a well-served dinner, which was thoroughly enjoyed. The long walk, the climbing, and the keen pure air of the hills had had their proper effect even upon the philosophers, who did not care to realise fully the poet's heroic resolve—

——I am resolved.
The mind shall banquet though the body starve.

The chair was occupied by the President, besides whom there were present—Rev. W. C. Fowle, Brinsop, and Rev. C. J. Robinson, Norton Canon, vice-presidents; Rev. Donald Carr, Woolstaston, Rev. William Elliott, Cardington, and Flavell Edmunds, Esq., honorary members; Rev. G. H. Clay, Aston Rectory; Timothy Curley, Esq., Hereford; William Carless, Esq., Hereford; Mr. R. B. Davies, Moor Court; F. W. Herbert, Esq., Credenhill Park; Joseph Greaves, Esq.,

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Lower Howsell, Malvern Link; Mr. James W. Lloyd, Kington; Rev. H. B. D. Marshall, Hopton Cangeford Vicarage, Ludlow; Rev. H. W. Phillott, Staunton-on-Wye; Rev. E. J. S. Rudd, Hereford; Theos. Salwey, Esq., Ludlow; Mrs. Salwey and Miss Twining, Ludlow; Rev. Berkeley L. S. Stanhope, Byford Rectory; Rev. William P. S. Stanhope, Holme Lacy Vicarage; Wm. A. Swinburne, Esq., Dulas, Hay; Rev. C. J. Westropp, Wormbridge; Rev. R. H. Williams, Bridge Sollars; Mr. Arthur Thompson, Treasurer and Assistant Secretary. The following gentlemen were elected members:—Trevor Fielder, Esq., Triley Court, Abergavenny; the Rev. Richard Powell, St. James' Vicarage, Hereford; Dr. Sandford, the Vinery, Hereford; Joseph Greaves, Esq., Lower Howsell, Malvern Link; George Henry Piper, Esq., Ledbury.

After dinner the President exhibited a curious bit of old Pottery from the Forest of Deerfold, for which he was indebted to the Rev. C. H. Middleton, who has recently resigned the incumbency of Lingen. It was a quaintly shaped bottle of green and white ware, of which Mr. Middleton had picked up the following history:—"Matthew Lowe owned land at Lingen a small estate now in the possession of William Webb, as well as other land at Deerfold, part of which is the 'Grove Head.' Matthew Lowe's father and grandfather had a house on the bank where the Asarabacca is found, and that bank formed the garden of the house. There are queer plants there still; besides the Asarum, single and double daffodils, snowdrops, and Lilium martagon. The house was burnt down about 80 years or more ago. My informant, he writes, Mrs. Webb—a very old woman—only knew it from what she heard old Matthew say. Matthew Lowe used to say that there was once, in his grandfather's time. or before that, a Pottery there—that the remains are still to be seen (which is the case), and that people, ages ago, settled there, when Darvel was all covered with oak, which oak they used to burn the pots with. There used to be a good deal of it about, but it is a long while since any of it was seen, except this queer old bottle, in which Matthew Lowe used to keep tea. They used to make pans and dishes, but all these have been broken long since." Mr. Middleton's letter further states that he has searched in vain in the locality in question for other like pieces of Pottery, though, on searching the ground, he could easily trace the old kilns, and discover, mostly in the Lingen Valley, several veins of whitish clay, which no doubt was the clay used. The bottle is carefully preserved at Moor Court.

The PRESIDENT afterwards said that he was happy to have to say that Mr. Flavell Edmunds was about to make a very practical suggestion, indicating a manner in which the members might all render service to the study of natural science, and afford materials for future students.

Mr. FLAVELL EDMUNDS said he merely wished to point out a manner in which the members might help the President to place on record for the use of students of natural history the facts connected with the very remarkable season through which we are now passing. The frosts which have marked the first fortnight of May, are so abnormal in their character, and have produced so many remarkable effects on vegetation, that a club of naturalists might fairly be expected to record them. They had observed that day how the trees, the shrubs,

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and the wild flowers had been damaged by the frost. He had even gathered cowslips partly withered by frost. Before this year he had never heard of the hardy narcissus (N. poeticus) being killed by the frost. Facts of this kind are interesting to all naturalists, and his suggestion was that each member should put down on paper the result of his observations on the subject, say from the beginning of April to the middle of May. On the President receiving these communications he would be able to compile from them a very valuable and interesting record of the abnormal spring frosts of 1874.

The suggestion was received with unanimous approval, but we fear almost as unanimously forgotten forthwith. The party then broke up, having spent a very pleasant day.

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Woolhope Naturalists' Field Club.

MEETING AT BUILTH,

FRIDAY, JUNE 19TH, 1874.

The Second Field Meeting for the season of the Woolhope Naturalists' Field Club was held at Builth on Friday, when there were present: — Rev. James Davies, President; Mr. Timothy Curley and Mr. J. Griffith Morris, members of the Central Committee; Rev. W. S. Symonds, Pendock Rectory; Mr. Flavell Edmunds, and Rev. W. Elliott, Cardington Vicarage, Secretary to the Caradoc Field Club, Honorary Members; Dr. Bull, Rev. T. M. Beavan, Mr. J. T. Owen Fowler, Mr. Joseph Greaves, Mr. Edward Howorth Greenly, Rev. J. Grasett, Rev. A. G. Jones, Rev. William Jones Thomas, Rev. J. H. Jukes, Rev. H. Cooper Key, Mr. Theophilus Lane, Mr. James W. Lloyd, Rev. H. B. D. Marshall, Mr. H. C. Moore, Mr. J. E. Norris, Mr. Evan Owen, Mr. T. Clifton Paris, Rev. H. W. Phillott, Mr. Alfred J. Purchas, Rev. Stephen Thackwell, Rev. H. W. Tweed, Rev. R. H. Williams, Mr. Arthur Thompson, Treasurer and Assistant Secretary. Visitors: Miss Browne, Miss M. Browne, Dr. Chase, Mr. H. Mier, Mr. Phillott, Lieutenant J. F. Symonds, Mr. R. Symonds, Rev. James Robertson (Llowes), Mr. E. D. Thomas (Wellfield, Hay), Mr. B. Whitefoord, Mr. David Griffiths.

At this Meeting Mr. John Percy Severn, Penybont Hall, Radnorshire, was elected an Annual Member of the Club.

The sky was covered with a gray haze when the Members assembled at the Barton Station, Hereford, and throughout the day the lofty hills were but dimly perceptible; but the atmosphere was clear in the valley, and about mid-day the sun shone out with great intensity, making the shelter of the woods around Llanelwedd House, through which the route lay, exceedingly grateful. The beautiful scenery of the Upper Wye Valley never showed to greater advantage. The picturesque reaches of the Wye with their setting of luxuriant foliage, green meadows, and corn fields, formed a succession of rapidly changing lakes as seen from the moving train, while the lofty hills of the Hatterill and the Radnorshire Beacon "stood dressed in the living green" of the young bracken, which faded off into the cold gray of the sward and the dark brown masses of rock, which here and there came to the surface. The view of the pretty gorge of the Bachowy

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with its fragments of rock, amid which the scanty thread of water made its way, and the noble glen of the Edw, with its huge masses overhanging the steep sides of the ravine, as if threatening every moment to join the equally large rocks below, around which the stream usually raves and foams, would have been perfectly beautiful had there been a little more water to give animation to the scene. Up as far as Builth there was no lack of water in the Wye, but above that town, as well as in the tributary streams of which we have written, there was too strong a resemblance to the Highland river described by Bailie Nicol Jarvie, in which "the chuckies were white in the sunshine." At the Llanelwedd rapids, the curiously contorted and worn lava masses which cross the bed of the river stood out bare and dry, so that the stream might have been crossed by a careful pedestrian without wetting his feet; and Roger Vaughan's hole, noted for its supposed unfathomable depth, had very little of its usual depth of ten feet of water. The botanists of the party were indeed able to gather without inconvenience specimens of the characteristic plant of these rocks, the purple-flowered chives (*Allium schœnoprasum*), which had lost none of its pungent onion-like odour from the drought. The view of the valley from the lawn of Welfield House, on the hill above the rapids, where the members held their meeting about 3 p.m. under the shade of the magnificent pines, limes, and cedars, was wonderfully beautiful. The rich valley, the pretty town, and the winding Wye, were set in a glorious amphitheatre of lofty hills almost worthy to be called mountains. From the towering Drygarn on the west, the eye passed along the lofty range of the Epynt, thence across the elevated valley to the distant hills of Talgarth, until the magnificent group near at hand, composed of the Garth, the Aberedw Hills, and the stern and solemn-looking Carneddau shut out the scene in the east.

The view thus charming to the eye of the mere lover of natural beauty was still more interesting to the gaze of the geologist. Standing on the floor of an ancient ocean, he saw in the Carneddau the "root" (as the Rev. W. J. Symonds graphically called it) of an extinct volcano; he traced the course of the lava currents that once poured streams of fire across the land; and he noticed how successive ages of life had left their traces in the beds which lie under, over, or against the lava, in almost every possible condition, here roasted with the heat of the lava—there full of fossils which have lain undisturbed since the rock was the mud of the ocean bed into which the trilobite sank when its life work was over. Raising his eyes, the spectator beheld in the varied forms of the hills the traces of the action of mighty waters; and by the help of Mr. Symonds's eloquent explanations, he might form a dim conception of the latter but still remote scene when the Wye flowed along a course not much lower than the top of Carneddau, and when the bay-like curves of the hillsides were actual bays of the mighty river. Thence downward how vast must have been the period of subaerial action, of elevations and depressions of surface, of denudation and sinking, until we reach the historic period. Judging from the fact that the little fort of Breinton, near Hereford, commands the British road which yet runs at its side and the ford at its foot, while in the same way the ford near Llanelwedd, which was used in Roman times, is still available, it is evident that the bed of the Wye has not been lowered

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for these eighteen centuries. How vast then must be the period since the river flowed along the terrace at Welfield made an island of the Garth, and at a distance of 60 miles down the river flowed in and out of the bone caves at Doward!

The day's ramble did not, however, begin with geology. The train in due course left Hereford at 9.25., took up members and friends at Credenhill, Moorhampton, Hay, and Builth, and at 12 o'clock deposited the party at Llechrhyd junction, where the Rev. W. Jones Thomas kindly undertook the duties of their guide for the rest of the day. The first halt was made at Cwrt Llechryd, close to the station, where Mr. Thomas led the party round the west side of the Ancient Earthworks, pointing out the care and labour bestowed upon them, and remarking that the spot was identified with the history of Wales at a period which is still full of the deepest interest to every patriotic Welshman. It was in that neighbourhood that Llewelyn, the last Prince of Wales, was slain. Not far off on one side lay Aberedw, where he vainly attempted to collect his followers, and where he was betrayed to the enemy, while near on another side was the place where he had his horse shod reversely; and in the same district was Cwm Llewelyn, "Llewelyn's Dingle," where he was beset, overpowered by numbers, and slain by Adam of Frankton; whilst Bedd Llewelyn, "the grave of Llewelyn," is still known as the spot where his body was interred. Although he was slain as far back as 1277, the facts are fresh in the popular memory, and people still speak with abhorrence of the traitors of Aberedw, and still honour the grave of the native Prince whom those men betrayed. The position of Cwrt Llechryd made it a place of importance, and the earthworks showed that it had been fortified with care. Mr. Thomas added that the name was interpreted as the flat place *(llech)* of the ford *(rhyd)*. He was glad to see Mr. Flavell Edmunds present, and should feel gratified if that gentleman would give them the result of his researches on the subject of earthworks and of that one in particular.

Mr. Flavell Edmunds then led the party to the highest part of the enclosure, adjoining the farm-house on the south side, and there pointed out the original *din* or camp, the nucleus out of which the whole might be said to have grown. He showed that it, as well as the outer entrenchment, was constructed on the circle, thus proving that the work was British, just as the use of the square and the oblong marked Roman work. He pointed attention to the simplicity of the construction, a mere circle of earth surrounded by the hollow out of which the earth was taken to form the ridge. In course of time, the ditch was usually deepened and widened, and the ridge was raised; and then a row of stakes was fixed into the ridge, after the fashion of the New Zealand *pah* of the present time. The Romans called the line of stakes a *vallus*, and the whole fortification, stakes, ridge, and ditch, has become known as a *vallum*. The Britons had the word *gwawl*, which bore the same meaning; and the Angles, coming later, borrowed the word in the form of *wall*. When the Romans constructed permanent camps, out of which grew their cities, they substituted a structure of stone for the row of stakes. The Saxons built little, but their *stoc* or *stow* was a place enclosed with stakes, and their *tun* was a house in the centre of an enclosure formed with

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earthwork and either stakes or stones. The Normans adopted the same ground plan in the construction of their castles, and thus the grand and lofty Norman fortress, such as once stood on the castle hill of Builth, was the outcome of the simple *din* before them. He then showed that the site was in the midst of an ancient marsh, and as the needs of the resident increased, he enclosed all the firm ground by cutting a deep trench all along its edge on the north and west sides, and building a ridge of earth through the middle of the marsh on the south and east sides. The Railway has cut through this ridge. Near the centre of the south side is the original entrance, which was in the marsh for security's sake; and the road of the war chariots probably led directly from that entrance to the west entrance of the little *din* or nucleus camp. Immediately behind this *din* the Norman *curt* was built, which is merely saying that in Norman times the lord of the district resided there and administered a rude justice. Looking at the site, far away from the "ford" of the Wye, and observing that it was actually in the middle of a bog or marsh, and having found that it was usually the nature of the actual spot which suggested the name, he ventured to dispute the correctness of Llech-rhyd. Welshmen would bear him out when he said that the word is not good Welsh; "the ford of the flat stone" would be Rhyd-y-lech. He suggested that the word is a corruption of Llech-wedd, the latter half of the word meaning a bog or marsh. He considered, too, that the word Llech means not a mere flat rock or stone, but a stone or place of sacrifice. The little central *din*, they would observe, is perfectly flat, and may have been used as a place of sacrifice. He added that he had the high authority of Mr. Joseph, F.S.A., of Brecon, as approving his reading of the word as Llechwedd.

After examining the earthworks, the party proceeded to the ford of the Wye, examining the rapids formed by the protrusion of igneous rock, and then followed Mr. Thomas to the several quarries. At Hooper's quarry the hammers of the geologists were speedily set to work and a number of trilobites were extracted from the Llandeilo flag. Several very good specimens of Ogygia Buchii were bagged. The company then proceeded to Welfield Hall, where they were courteously received by E. D. Thomas, Esq. Mr. Thomas hospitably offered luncheon, but as the party was very large, and the hour fixed for dinner at Builth was fast approaching, while the chief business of the day—the address of Mr. Symonds—remained to be attended to, the invitation was declined with thanks.

As soon as the party had assembled under the shade of some noble trees, conspicuous among which were Hemlock Pines, Pinus Douglasii, and other gigantic coniferæ, the Rev. W. S. Symonds proceeded to deliver as follows an address on the geology of the district:—

Mr. Symonds commenced his address by saying that some years had passed away since he had the pleasure of meeting the Woolhope Naturalists' Field Club on the banks of the Wye near the ancient Castle of Buallt. Once more they had assembled in a locality rich in the records of byegone ages, rich in its local history and traditions, and still more rich in its geological records respecting animals which had lived and died long ages before any human tradition had a beginning. He was glad to have heard much that was interesting from Mr. Jones Thomas and

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Mr. Flavell Edmunds, on the ancient haunts of Llewelyn, the last native Prince of Wales, and on the archæology of the district, and he hoped to hear still more; but they might be assured that it was impossible for the lover of history and historical lore to explore Wales, and ramble hammer in hand among its mountains and vales without thinking of the gallant race of mountaineers which for years bid defiance to the Romans, again and again defeated the Saxons, and drove many a Norman king half wild with their gallant stand for liberty. "Hospitable and generous, full of poetry and wild native music," who did not revolt at the atrocious cruelties practised upon them by the Norman kings and their brigand chiefs? Referring to the geology of the picturesque country around Builth, he reminded his hearers that the scenery they so much admired is due to physical causes, and those forces of nature which through long ages have been at work shaping the mountains and hollowing out the vales. Earthquake and volcanic action; denudation by the action of former seas; denudation by atmospheric and subriaeal forces in later times, have all been active in the Builth country. As regards earthquake and volcanic action there must have been somewhere in the Carneddau an active volcano with its crater above the waves of the surrounding Llandeilo seas, for great masses of volcanic ash and pumice were interstratified with the Llandeilo strata. The Carneddau trap masses were merely the roots of the former volcano, and they had good proof that the crater was subaerial, and poured out masses of lava and showers of ashes, for there was evidence that the ashes and lighter volcanic materials fell after eruption into the surrounding waters where they afterwards sank and became stratified sea beds, or interstratified ash beds, in which were sometimes found the Trilobites, Lingulas, and Orthoceratites, which once lived in the Llandeilo seas.

When the Carneddau volcano was active in the Builth district there were volcanos in activity and force where now are the Aran mountains in North Wales; and probably Cader Irdis, which had a volcano in activity in earlier times (Lower Llandeilo period) still continued to evolve its fires when Carneddau was active also.

The fossil remains of the animals found in the Upper Llandeilo rocks of the country around Builth are the Silurian forms of crustacea known as Trilobites, which are beautifully preserved, as are also some of those chambered shells, such as the Orthoceras, which are of the highest forms of molluscous life. Lingulas, and other shell fish too, were abundant in some localities, and on the lower shell fish it is probable that the high class Orthoceratites preyed. Both Trilobite and Orthoceras read a lesson to those, who chose to learn, of deep importance in the history of geologic creation, as the evidence now stands concerning it. The Upper Llandeilo rocks are often full of the remains of Trilobites probably destroyed *en masse* by an outpouring of lava from Carneddau into the sea. And no one can study these stony records without observing that the laws of birth, and life and death, were as firmly established in those early ages as they are at present. The young Trilobite, side by side with its parent, alike yielding to the same fate, tells us plainly that these mysterious laws have been at work for unnumbered ages,

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and that every one of those fossil forms was once endowed with the gift of life. Then again that straight Nautilus, the Orthoceras, represents, as far as we know, the highest form of living animal the Llandeilo seas nourished. No remains of any fish or other vertebrate animal have ever been found throughout all the length and breadth of the Lower Silurian strata wherever they have been searched, and Sir Roderick Murchison called the Orthoceratites "the scavengers of the seas," and considered that they occupied in those times the place which in after epochs was to be filled by the predaceous fishes. And such, indeed, appears to be the teaching of the rocks! All geologic evidence now tends to prove that the simpler forms of life were the first forms called into existence. Trilobites, Orthoceratites, and other mollusca preceded the fish, the fish preceded the reptile, the reptile the bird, the bird the mammalian quadruped, and the mammalian preceded man.

The Caradoc or Bala strata, which overlie the Upper Llandeilo rocks west of Llandovery and Llandeilo, are not found in the Builth district. They were probably denuded here, for the May-hill rocks (or Upper Llandovery deposits) are found full of Pentameri and other characteristic fossils resting unconformably upon the upheaved Llandeilo strata, and there interbedded with lavas and volcanic ash. In order to see these strata the explorer must go westwards and explore the hill country around the Drygarn mountain and near Llandeilo and Haverfordwest. They appear also on the banks of the Wye, near Newbridge, where the Tarannon shales rest unconformably upon them.

In walking from Builth by the beautiful grounds of Welfield with its Llandeilo Trilobites Ogygia, Asaphus, Ampyx, and Agnostus, and its lingulas and orthides among its [shells, you arrive at Pencerrig, another property of the family of Thomas, and here you find igneous rocks both eruptive and stratified with Llandeilo flags, while on and against them rest the May-hill beds (Upper Llandovery rocks) full of fossils, and which constitute the base of the Upper Silurians. These beds may be seen at the upper end of Pencerrig Lake. Welfield and Pencerrig are classic ground to the geologist, for here among the groves and hills and quarries have been the haunts of Buckland and Conybeare, Murchison, and Sedgwick, who in former years were attracted by the rich profusion of Trilobites in the shales and the beauty of the surrounding scenery.

Mr. Symonds hoped and trusted that the owners of these houses would gather around them, if indeed they did not already possess them, some of the beautiful specimens which geologists of the past had travelled hundreds of miles to see, and he might predict the same of the geologists of the future.

The Upper Silurians of the Builth district take us into beautiful scenery, for there is Aberedw, often the home of Llewelyn, and its picturesque glen, and in the rocks there I have found Pentamerus Knightii, that noble Upper Silurian shell which is so abundant in the Aymestry limestone of Aymestry and the Ludlow country. Near Llanstephan, too, there are at Pwll-ddû beautiful rocks clothed with foliage which furnish many an Upper Silurian fossil, and the Calymene Blumenbachii and other Trilobites may be found below the waterfall of the Black Rock. Here, too, we have an example, on a limited scale, how the hardness of

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rocks in one place and their softness in others produce the mountain and rocky scenery we so much admire.

Let the observer mark at Builth and around it, how a trap-dyke stands out in its hardness, and the softer shales weather around it; or how some rocks are hardened into limestone by the decomposition of shells and other organic remains; and, again, how a hard silicious mass defies the elements; and how the stream corrodes the channel; and Builth, Aberedw, and Pwll-ddû may teach him a lesson which hereafter may be useful on the Alps, or the Andes. It is in the upper Silurian strata (Lower Ludlow series) and in the Passage Rocks, between those deposits and the Old Red, that we first meet with the relics of vertebrate life in the bones and plates and teeth of a few small fishes. Here we, too, meet with evidence of the progression of life, and of development throughout unnumbered ages. It was my friend Mr. Banks, of Ridgebourne, brother of our President, who first found numerous fish remains in the Upper Ludlow Passage Rocks, and advanced geology by those important discoveries. The Lower Old Red Sandstone is rich in the remains of fish; the Upper Old Red is singularly deficient, but then we have few local geologists who search it. There is, I am sure, a rich storehouse yet remaining for the researches of future explorers, and if the love of the rocks only affords to anyone present one-half the happiness it has afforded to me, I shall rejoice that I have once more been enabled to advocate the wonders of geology by the beautiful rocks of Builth. When we are on the summit of Carneddau we see the summits of the Breconshire and Carmathen Vans rising above the hills of Epynt, and we learn how the Old Red Sandstone stretches away beneath the carboniferous rocks of the South Wales coal field. But there is more than this to a physical geologist who examines these old red rocks far and wide as I have done throughout all the Silurian region. When I remember the old red outliers away in Anglesea, and near Denbigh on the north, and again by Marloes Bay, in Pembrokeshire, on the south, I feel sure that the whole of the Silurian rocks of Wales and Shropshire were once covered by this great series of rock strata which are now separated, between Ireland and England, by the Irish Sea. The Silurian rocks are, in fact, set in a broken framework, of which here and there only patches are left; and I think, moreover, that these patches are the representatives of a vast continuous sheet of old red sandstone which was once also overlaid by carboniferous deposits since denuded also. This, however, hardly belongs to the local geology of Builth. Mr. Symonds concluded by saying that one great reason why he had always so much pleasure in attending the meetings of the Club was that their proceedings were recorded not only in the transactions of the Club, but previously in the annals of the *Hereford Times*. He was glad to see the editor present, and to say how much he felt indebted to him for the care and accuracy with which the proceedings of the Club had been reported, and for the services thus rendered not only to the Club but to the cause of science (applause). In the course of his investigations in the Doward bone-caves he had met with a proof of the interest that existed in the minds of the general public. One day he met two working men out of the Forest of Dean, who told him that they always looked out for the reports of the Club's meetings in the

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Hereford Times, and read them with great pleasure (applause). He was glad to see Mr. Edmunds present that day, because he knew that he would give an interesting and faithful account of that day's proceedings (applause).

Mr. EDMUNDS said that his friends must think him a very ingrate if he failed to acknowledge the series of compliments which Mr. Symonds had been so kind as to pay him and to the *Hereford Times*. If he had rendered any services to the Club and to natural science, he had been amply repaid by the pleasure and instruction which he had received from it. When, at the formation of the Club more than twenty years ago, he originated the practice of reporting meetings of this kind for the public, he did so because he had imbibed a love of natural science from coming to reside in the district; and ever since then the reporting of its meetings had been a labour of love to him, and a mark of his gratitude for the instruction which he had thus obtained. He owed to Mr. Symonds most of what little he had acquired of geology, and to other members most of his botany; and he had much pleasure in learning that he had been successful to so great an extent in making the reports of these proceedings interesting as well as instructive to others. In so saying he wished particularly to acknowledge the zeal and ability with which, when from ill health and other causes he had for a time relinquished the work, it had been taken up by successive Presidents at the Club. To Dr. Bull especially the Club's thanks were due for the excellent manner in which he had for seven or eight years reported the Club's transactions, and the admirable volumes which appeared under his care. Last year, the President had found time amid his many engagements to report the meetings most ably; and his reports would appear in the volume of the Transactions now in course of preparation. He might just say that various causes had combined to delay the printing, but that it was going forward, and by and by he had no doubt the volume would be placed in the hands of the members (applause).

The PRESIDENT presented the thanks of the meeting to Mr. Symonds for his most able and eloquent address.

Mr. JONES THOMAS seconded the proposition, and expressed a hope that Mr. Symonds would permit his address to appear in full in the Transactions. (applause).

The motion was carried by acclamation, and was suitably acknowledged.

The President then presented the thanks of the meeting to the Rev. Jones Thomas for his kindness in guiding the party that day, and Mr. Thomas, of Welfield, for his courteous reception of that large gathering of visitors.

The party then, after a hasty visit to Pencerrig, made their way direct to Builth, it being then nearly two o'clock, and the time of departure of the train not allowing of the intended visit to the summit of the Carneddau. Sooth to say, too, the philosophers were anxious to recruit their physical energies. They had fulfilled the first part of the poetic adage:

I am resolved
The mind shall banquet, though the body starve.

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The mind had banqueted richly, and the body put in its claim to attention in turn. By the time they sat down to table at the Lion Hotel, Builth, they were fully resolved to emulate the unscientific hero of inglorious times, who, "nobly daring, dined." It was not a very easy work after all. The dinner, which was a good one, was very imperfectly served. The number was, indeed, some dozen or so more than had been expected, but there was literally nothing that could be called waiting, even at the ratio of the original number; and many of the guests had to rise from table and fetch from the bar the articles they wanted, or make shift to dine without. The extra delay thus caused rendered it impossible to hold any meeting or listen to any papers after dinner. From the dinner table the members had to hurry off to the train, which steamed out of Builth Station on the homeward route about 5.45, and reached Hereford about 7.35 p.m.

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Woolhope Naturalists' Field Club.

MEETING AT KING ARTHUR'S CAVE, WHITCHURCH.

The third Field Meeting for the season of the Woolhope Naturalists' Field Club was held on Friday, July 17, at the beautifully situated village of Whitchurch, in this County, the object being to visit the Caves on the Great Doward-hill, which have been investigated with such instructive results. The Rev. W. S. Symonds, F.G.S., by whom the investigation was conducted, kindly acted as guide to the caves and delivered an admirable address to the large company which assembled in and at the entrance of the principal cave, known as King Arthur's Cave. The members and visitors present were :—

The Rev. James Davies, Moorcourt, President; Misses Davies (2); Rev. Sir G. H. Cornewall, Bart., Hon. Sec.; Sir James Campbell, Bart., Coleford; Lieut-Col. Symonds, High Sheriff; Rev. William Elliott, Cardington; Rev. Wm. S. Symonds, Pendock; Mr. Flavell Edmunds; Mr. M. Mogridge, Captain Rankin, Bryngwyn; Mr. Frank Symonds, Pendock; Rev. Thomas, Mrs. and Miss Phillipps, Dewsall; Mr., Mrs., and Miss Swinburne, Dulas, Hay; Rev. S. Thackwell, Little Birch; Mr. Fowler, Miss Bucknell, and Miss Teare; Rev. J. E. Jones-Machen, Llanthewy Rectory, and Rev. B. Adams; Dr., Mrs., and Miss Lawrence, The Priory, Usk; Rev. A. G. Jones, King's Caple; Mrs Hedger and Miss Goss; Mr. E. Colt Williams, Mrs. E. C. Williams, Miss E. P. Hurle, Miss Timberlake, and Mr. Seer; Mr. Jos. and Miss Greaves, Lower Howsell; Mr. Cam, Hereford; Mr. J. H. Wood, Tarrington; Mr. T. Clifton Paris, Hampton Lodge; Mr. Jas. W. Lloyd, Kington; Mr. and Mrs. Griffith Morris; Mr. T. Curley, F.G.S, Hereford; Rev. B. and Mrs. Ruck Keene, Newent; Rev. R. H. Williams, Byford; Rev. G. H. Clay, Aston Rectory; Capt. Power and son, The Hill Court; Mr. and Mrs. F. W. Herbert, Credenhill Park, and Miss Eckley; Mr. Fisher, Trebandy; Mr. G. V. Banks, Birch House, and party; Rev. F. S. Stooke, Wellington Heath; Rev. C. J. Westropp, Wormbridge; Rev. F. Merewether, Woolhope; Colonel Scobell; Capt. and Mrs. Helme, Woolhope Court; Rev. H. Cooper Key, Stretton Sugwas; Mr. D. Long, Cheltenham; Rev. D. Seaton, Goodrich; Rev. H. Hornby; Mr. Arthur Thompson, Treasurer and Assistant Secretary; Miss Maria Jones, Springfield, and Miss Vaughan, Madley; Mr. Henry Southall, Ross.

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The gathering consisted of several parties, the largest of which left Hereford by the 9.45 train for Ross, where they received an addition to their numbers, and thus started in a train of carriages for Whitchurch. The route taken was along the N. Bank of the Wye, past Wilton with its Ancient Castle, long the seat of the Greys of Wilton, for ages lords of the district still known as the hundred of Greytree (in Old English Grey's *treow*, or trees); and thence to Goodrich, famous for its grand old Castle, occupying the site of the abode of Godu, sister of Edward the Confessor, and its modern mansion, celebrated in these later days for the unequalled collection of Ancient Armour now at South Kensington, but originally gathered here by the eminent antiquary, the late Sir S. R. Meyrick. The party did not stop, however, to visit either Castle or Court, or the Church, where Dean Swift's grandfather was incumbent during the great Civil War, but made their first halt at Whitchurch, where they were joined by parties from Bryngwyn, and by the Rev. W. S. Symonds, Colonel Scobell, Sir James Campbell, Bart., M. Mogridge, Esq., and other visitors.

Before making their way to the caves, which part of the journey had necessarily to be performed on foot, the party found Mr. Symonds's beautiful collection of fossils from the caves laid out for inspection at the Inn at Whitchurch. They consisted of bones, teeth, skulls, and other remains of the rhinoceros, mammoth, cave lion, cave bear, and hyæna, and skulls of *Bos longifrons*, an ancient British ox, the badger, and other remains not fossilised, together with specimens of the pebbles which had been washed into the caves, and others of the same rocks, which had been brought for comparison from Builth. Among the later remains were specimens of the flint knives which had probably been used by the human beings who had inhabited the caves in ages long subsequent to those of the cave-dwelling lions and bears.

These had been found along with the bones and skulls of the *Bos*, and other animals, which they probably used for food, and with them two *cores* of flints, or pieces from which flakes had been chipped to form knives. These must have been brought to the spot by human hands, as there are no flints to be found within fifty miles, nor indeed anywhere west of the Severn. The condition of the fossil remains showed that the prey of the cave lions and bears had been chiefly the rhinoceros, which must have inhabited the Wye, although now only found in tropical countries. The lions and bears had dragged the carcases into the caves, and after devouring the flesh had left the marks of their teeth upon the bones, and afterwards dying in their dens, had themselves been turned to earth, and left their bones and teeth as evidences of their presence. Beside the teeth of the cave bear lay a tooth of the common brown bear of Europe of the present day. The teeth of many of the animals were in a state of almost perfect preservation, showing that the animals must have died or been killed while in youth or vigorous maturity. It was stated that one of them was pierced, but there were no other evidences that either the carnivora or the herbivora had ever experienced the tortures of tooth-ache. One of the members remarked that he had read or heard of instances in which elephants of the present day had been found to be suffering

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from tooth-ache, and the lions of North Africa are said to become specially dangerous to human beings when age or disease has damaged their teeth, and thus induced them to seek for prey of a more fleshy kind than the wild animals which form their ordinary food. Wild deer, wild cattle, and even the mountain sheep and goats are too tough eating for the old lion with his carious teeth. Still the instinct of the lion for fleshy food was shown in the abundance of the bones of the large bodied rhinoceros, as already noticed. Mr. Symonds explained the nature of the remains, as a preparative to the intended visit of the company to the caves from whence they had been exhumed.

A toilsome walk along the steep lanes under the pitiless sun of July, led the party to the western slope of the Great Doward. There, embowered in the delicious shade of the overhanging woods, were the two principal caves, which had been lighted up for the occasion. The path, a woodland path, such as that in which Æneas is said to have met his goddess mother, leads past the caves. It was a "ladies' day," and on this occasion the wood was thronged by a distinguished party, many of whom might vie with the goddess and her hero son in their personal beauty, while all were equally eager in a nobler chase than that which Virgil has described—the pursuit of geologic knowledge. When all were gathered around the entrance of the noble cave named after the British hero king, himself a mighty hunter and a chief of men like Æneas, the scene was a most picturesque one. As the Lecturer stood upon a point of rock discoursing eloquently upon the grand facts of primæval history which the cave had yielded to his enterprise, the bright sunlight making a "chequered shade" upon the greensward, dotted with the gaily dressed groups, and blazing full upon the gray rocky portal, while the dark recesses were made bright with artificial light reflected from the earnest upturned faces of the auditory, one could not help (mentally) echoing the exclamation of Byron, whatever might be said of the appropriateness of the consolation which he administered to himself :—

> O that I were a painter ! but my tints
> May serve perhaps as outlines or slight hints.

When next the club holds a meeting in King Arthur's Cave, "may we be there to see !" and may the Club provide at least a photographer to preserve a "counterfeit presentment" of the interesting scene !

The Rev. W. S. Symonds delivered his address as follows :—

Enough has already been said and written on the subject of King Arthur's Cave on the Great Doward, as well as on the adjoining caves on the property of Mrs. Bannerman, of the Leys, to show beyond a doubt that these caverns were formerly the dens of wild beasts, which in other ages of the world inhabited portions of what is now Great Britain, in vast numbers. There are caverns in England and the Continent into which the bones of animals and the cave earth and other foreign materials have been washed in by the flow of water from the surface or through fissures. There are others where the remains of numerous animals are found gnawed and scored by the teeth of carnivorous animals, like those found in Wookey Hole and Banwell in Somersetshire, Kirkdale and Settle

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in Yorkshire, or the caves of Gower, near Swansea, in South Wales, and especially the celebrated Kent's Hole in Devonshire, at Torquay, which has yielded to the researches of Mr. Pengelly and others upwards of fifty thousand bones. Such too were King Arthur's and the Doward Caves—at least those that occupy a height of from 400 to 500 feet above the river. Of the *lower level* caves I will speak just now The bones of the herbivorous animals are all more or less gnawed and bitten, and the remains of such destructive carnivores as were the cave lion and hyæna are found in considerable numbers associated with the bones of the herbivores, and prove beyond a doubt, that the mammoths, reindeer, bison, and rhinoceros fell a prey to those destructive carnivores, and that their carcases were dragged piecemeal into their dens. I shall allude to-day to the consideration of the contents of these Wye Caves, and these only, inasmuch as they are somewhat remarkable for the abundance of the remains of the long-haired rhinoceros (R. tichorrhinus) whose bones are found in great numbers in Northen Russia and Siberia associated with the relics of the mammoth or long-haired elephant.

Finally I shall allude, briefly, to the great changes which have taken place in the geographical and geological conditions of this country since the time these caves were tenanted by wild animals, and to the evidences of the coexistence of man with the mammoth. First with regard to the remains of the herbivores found in the Wye Caverns. We have the remains of mammoths, young and old, from the great fore-arm in the possession of Mr. Bannerman, which was evidently dragged in by either a cave lion or a hyæna, and hidden in a chink in the limestone rock for a future gnawing, down to the teeth of a young calf mammoth, several of which were found in King Arthur's den. The mammoth is only one of about some 40 species of fossil elephants known to palæontologists, and you are aware that there are now only two species of existing elephants. It is found abundantly in caves and ancient river deposits throughout England and Wales, and was once very abundant in Russia, Siberia, and Germany. It has been found in Siberia with its flesh preserved in ice, and clad in hair and wool with a long shaggy mane. It grew to a larger size than any living elephant, and the food on which it fed has been preserved in its stomach. It fed on the Arctic willow and birch and pine shoots. The store of fossil ivory furnished by this now extinct animal in the North of Russia is extraordinary, and not very long ago the *Illustrated London News* had an engraving of a room full of its gigantic curved tusks at the London Docks. Its teeth are as well known as the Gryphœa incurva of the Lias, and some of them have been exhibited to-day. Those who will take the trouble to examine the collections at the Gloucester Museum and at Mr. Bannerman's will see from the teeth of the rhinoceros, young and old, how numerous the individuals of this animal must have been on those ancient lands of the Forest of Dean. On the banks of the ancient Wye it formed the principal prey of the hyænas, and a vast number of its bones have been disinterred from the caves in the shape of splinters and gnawed fragments, the enamel of the teeth being too hard even for the digestion of a hyæna. The quantity of individual heads of this animal dragged in must have been very great. So far as my knowledge extends all the teeth we have discovered in the Wye caves belong to the rhinoceros tichorrhinus (strongly

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walled nose), the remains of which are very abundant in caves in England and the beds of our ancient rivers, especially of the Thames. Entire specimens of the skeletons of this animal have been found in Siberia, and it is known to have been furnished with a protecting covering of hair and wool like the mammoth. It once ranged throughout Europe in vast herds. Of the deer tribe Mr. Boyd Dawkins determined the presence of the great Irish deer (Megaceros Hibernicus), and the teeth of this animal are tolerably numerous. It was a true deer intermediate between the fallow and the reindeer, and was once very abundant in Ireland. These perfect skeletons are occasionally disentombed from lacustrine marls below the peat mosses, and you may see one in the British Museum.

The Earl of Enniskillen has a grand collection of heads with antlers, several of them showing an expanse of 10 feet across from tip to tip. I need hardly say that this noble animal is now extinct. There is evidence that it survived in Ireland until the habitation of that country by the hunter, man. The reindeer's teeth and horns, the horns being gnawed, were also detected by Mr. Boyd Dawkins among our earlier specimens, and relics of this animal have been found since. It appears that this animal was still living in the north of Germany in the time of Cæsar, since which it has retreated to Northern Europe, Asia, and America. It has been extinct in Great Britain for a long period, though there is evidence that it lingered on to the formation of the peat bogs of Scotland. So numerous was it once in Great Britain that Dr. Falconer was enabled to determine the remains of more than 1,000 individuals from one cave at Gower, in the Museum of Lieut-Col. Wood. It is found in our English Caverns and river sands and gravels, and in a very few instances in peat mosses. The condition of its bones and antlers proves that it fell a prey to the cave hyæna, and it is an important animal, as we may from its presence reasonably infer the kind of climate in the days when its herds roamed in Dean Forest and over the country where is now Wales. It requires for its food the reindeer, moss and lichen, with other sub-arctic plants, which now cover the great space round the Arctic Seas. It now thrives in the zones where once the Mammoth and the Tichorhine Rhinoceros fed on the Arctic willow and birch, and fir cones and shoots, and where they were sheltered by wool and hair from the inclemency of the climate. It is associated, too, in various parts of Great Britain with the remains of the marmot and lemming, and even that now most northern quadruped, the musk ox, which with the reindeer, as the climate became warmer here, had to migrate northwards and northwards still, in order to find the herbs on which it feeds, and the climate which suits its condition.

The remains of the bison of Europe, or the Auroch, are comparatively rare in the Wye caves, although they are numerous in the caves of Banwell and other parts of Somersetshire. We have, however, found bones and teeth. The bison of Europe, once so abundant on the continent and ancient Britain, is now exclusively confined to the forest of Bialowikza, in Lithuania, where it is protected by the most stringent laws to prevent its utter extinction. It is not adapted to so cold a climate as the reindeer or the musk ox. One relic of the old British bull (Bos longifrons) was found in the upper surface earth of one of the caves belonging to

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Mr. Bannerman, but not with the remains of the extinct mammalia, as far as I can understand; and with it were the remains of the beaver. Again, however, I must remind you that the bones of the rhinoceros are the most numerous by far, and that this animal was *par excellence* the prey of the hyænas on those great prairies of which a mere fragment now forms the Doward and the Forest of Dean. No remains of sheep or goats have been found in the caves save in the uppermost surface mould. Along with these extinct herbivorous animals we find the remains of great carnivores, or beasts of prey mixed together, and especially of the hyæna, which we know now is in the habit of hunting in packs, pulling down an animal by hanging on to its flanks and limbs, eating and tearing the flesh, and then carrying off portions of the carcase to their dens and caves. In South Africa the hyæna is often a man slayer, and the cave hyæna was most nearly allied to the existing spotted hyæna of the Cape. I have more than once watched the hyæna in the Zoological gardens crunching huge beef bones and gnawing them as his predecessor formerly crunched the bones of the rhinoceros on the banks of the Wye. The existing hyænas are cautious and cowardly animals, but a wounded or aged rhinoceros or lion has no chance with them. The remains of the hyæna were numerous in King Arthur's cave, and with it were associated the coprolites or fossil dung, of this animal. The jaws and teeth exhibited speak for themselves. They cannot be distinguished in shape and form, but are often larger than those of the spotted hyæna of South Africa.

The Cave Lion (Felis spelœa) was a great feline animal which was once numerous in Ancient Britain, and has left certain testimony of his former existence in Dean Forest by his teeth and canines in the cave of King Arthur. These may be seen in the museum at Gloucester, and one fine specimen we exhibit to-day. This was disinterred by Mr. Scobell, to whose aid I owe so much, along with the remains of the rhinoceros and great Irish deer, during our last researches. Mr. Boyd Dawkins and Mr. Sandford, who have paid great attention to this great lion of the British Caves, and which preyed like the hyæna upon the mammoth, woolly rhinoceros, reindeer, and bison, believe that it was the ancestor of the great tropical lions of Asia and Africa, and a larger and stronger variety of the same species. The cave lion was very abundant in the Mendip Hills, and nearly a thousand specimens of the bones of this animal have been collected from caves between Banwell and Weston-super-Mare, and the old city of Wells. Between six and seven hundred specimens may be seen in the Taunton Museum. I have seen its canines in the collection of Mrs. Williams Wynne, at Cefn in Denbighshire, and again at Col. Wood's, from the cave of Ravenscliff and Northhill Tor, near Swansea. The canines and carnassials of the cave lion in Gloucester Museum from King Arthur's cave are very fine. The first thing that strikes us now is the anomaly of finding carnivores such as the hyæna and cave lion associated with such animals as the mammoth and reindeer, as these carnivores are now found in tropical regions, but similar remarks would apply to elephants and rhinoceroses which are now nowhere found in cold climates. Besides this, the existing tiger of Bengal is gifted with such an adaptation of constitution that it pulls down the reindeer in the mountains of the Altai just as it springs upon the antelope in the

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jungles of Bengal. It endures the cold of a Siberian winter as well as it endures the heat of a tropical forest, and its jaws and teeth and bones may be found alike among the Alpine willows or the tropical palm. We know what the food of the reindeer, mammoth, and tichorhine rhinoceros was, and we may be certain that the carnivores which feed upon them were adapted to the climate that suited these herbivores. *Apropos* of the British lion it happened to me not very long ago to say before a British lady that we had found the remains of his majesty in King Arthur's cave, with the remains of elephants and rhinoceroses. She smiled contemptuously, and said, "Well, Mr. Symonds, you may believe it, but I don't; not a word of it." Of course all I could do was to bow profoundly. I shall never attempt to convince that recent British lady. But to the ladies of the Woolhope Club I would say, go and see the skeletons of the recent animals in the College of Surgeons, and then the wonderful collection of fossils, cave lions, and hyænas in the museum at Taunton, and you will soon recognise in the teeth and jaws sent to Gloucester Museum and those which you see to-day the absolute identity of structure, and will make one step towards a lesson in that wonderful science of comparative anatomy, which restores to our knowledge the animals of bye-gone ages before lions or hyæna ever existed.

The occurrence of human bones in these caves is limited to the superficial deposits, and none have been hitherto found fossilised as are the remains of the rhinoceros, horse, elephant and hyæna, but flakes of flint and scrapers have been found in such positions that it is impossible to avoid the belief that men occasionally frequented the caves during the occupation of the hyænas. There is no flint in the district, and none occurs for many miles, so they must have been brought there by human agency. I myself exhumed several, and so did Mr. Scobell during the first excavations at King Arthur's cave, lying side by side with the bones of the extinct animals, and sealed and protected by the same stalactitic floor. With these also may be seen in Gloucester Museum some rude stone cores, which the cave men attempted to flake off and then threw aside. These cores are struck from old Wye pebbles, and are like some I saw at Mentone in the museum, and which came from the caves where the skeleton men of the Red Rocks are found imbedded, with the remains of the extinct animals also. There is one of these cores placed upon the table in order that those ignorant of the subject may see what a so-called core is, viz., a stone from which flakes for scrapers or knives have been struck off.

I visited the Mentone Caves again and again, in company with my friend Mr. Mogridge, who explained to me the principal phenonema when the caves were searched; and not only in the caves where the skeletons are found at Mentone, but at Nice and various other places in France, we find overwhelming evidence that man occasionally frequented those caves at the same time that animals, now extinct, lived on the shores of the Mediterranean. And such, I believe, is the evidence of these flints we find in the caverns of the Wye. I have already occupied so much time on this occasion, in describing the animals found in the Wye caves, that I must deal briefly with the physical geological phenonema

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presented by them, having already alluded to them in considerable detail (see Records of the Rocks, Geological Magazine, &c). But it will be interesting to some amongst you if I attempt to give some idea of the geological period, when the wild animals lived in the Forest of Dean. Those amongst you who are acquainted with the Records of Geology, will remember that during the "Pliocene ages" of Tertiary geology, the length and breadth of Europe, in its southern districts, was the home of vast herds of rhinoceri, hippopotami, mastodons, elephants, tapirs, stags, beavers, and other animals. With these were various tigers, lions, and hyænas, and especially the great tiger (the Machairodus Cuthidens) with canine teeth like a sabre. During that period we know from fossil evidence of hundreds of extinct animals, that Europe and Africa were joined together by land, over which the quadrupeds roamed, and that land reached from continent to continent in several points, where now roll the waves of the Mediterranean sea. There are caves and fissures at Malta, Gibraltar, Sicily, and Italy crammed with the remains of African forms of leopards and hyænas, lynxes, and bears, associated with hippopotami, extinct elephants. and rhinoceri, which then roamed in thousands over land now submerged beneath the Mediterranean, and then stretching on to what is now Southern Europe. It was during the close of this pliocene period that an ancient forest land of Great Britain, now known as the Cromer Forest bed of Norfolk and Suffolk, was tenanted by three species of elephant, two rhinoceroses, hippopotami, a gigantic beaver, numerous stags, and large carnivora, but no *arctic forms* of mammalia such as reindeer or the woolly rhinoceros, or mammoth, or marmot, are found amongst them. But the climate, which in the pliocene ages was in Europe comparatively warm and temperate, was gradually changing and passing into the Arctic severity of the *glacial period*, and, as we now know, with the glacial period there ensued subsidences of land, which, in certain localities, was afterwards re-elevated, but again there are large areas of that once great continent which are now washed over by the salt sea waves. These subsidences of the glacial lands occasioned the submergence of immense tracts of land between Africa and Europe, and England and France, and Ireland and England, and large areas of these ancient lands are now covered by the Atlantic and Mediterranean seas, land which was once the home of thousands of living animals. As the glacial period went on, the cold of the northern regions increased and this change caused a corresponding change in the animals which frequented the land. The Southern forms of elephants, rhinoceri, deer, and antelopes retreated *southwards* with the accompanying carnivora, and are now represented by the African forms of animal life so well known to the zoologist and hunter, while their places were taken by Arctic and sub-Artic animals such as the mammoth and tichorhine rhinoceros, the reindeer and musk ox, Irish deer, bison, marmot, and others, thousands of which were frozen up in the bitter regions of the glacial north. So severe was this cold of the glacial epoch, where even now is the sunny south, that I have knocked out the teeth of the bison and woolly rhinoceros in rocks on which now grow the orange, the lemon, and the palm, and seen caves which contain the remains of the reindeer, where now the fire-fly flits by the Mediterranean shores. I have seen, too, the action of glaciers, the relics of which once swept down the vales where now the olive tree bears its fruit and the cork tree sends forth her branches.

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Now it is to the close of the glacial period we must refer the occupation of the Wye caves by the cave lion and hyæna, for they preyed upon the Arctic elephant (or mammoth) the Arctic rhinoceros, and the reindeer, all invading forms so to speak, driven by the cold from the distant North. Probably the climate here was comparatively temperate, though there is abundant evidence that glaciers then filled all our mountain vales, and in some places stretched down to the sea. During the same period the cave animals left numerous remains in the old river deposits of that epoch, and in these river deposits there are often large masses of angular rocks, which could only have been carried by floating ice. They lived, too, before the valleys had been excavated by the existing rivers to the present depth, and it is a question to me if the Wye has not excavated its channel through hard limestone rocks three or four hundred feet since the cave lion lived and died by the long ago ancient Wye.

In King Arthur's Cave we found a quantity of silt, evidently deposited by water, and in this silt were several Wye pebbles, which are just like those now washed down by the Wye from Plinlimmon and Builth. I believe that an ancient Wye once rolled its waters into the cave in flood time; those who do not can perhaps explain better the presence of the silt and pebbles, which certainly did not come from the stars. This summer, too, I have been enabled, through the generosity of a few friends—Mr. Crompton Roberts, Colonel Ratcliffe, Mr. Lucy, Captain Price, and others—to open two more caves at a lower level than is King Arthur's or the other Great Doward caverns. The result was unfortunate as regards obtaining fossil remains of the extinct animals. The first cave at Branland has only furnished the tooth of a deer. The second on the right bank of the Wye, about 200 feet above the river, has furnished the canine teeth of the common bear, but no extinct mammalian remains. It looks, therefore, as if the mammoth and hairy rhinoceros did not live on with the hyæna down to the period represented by these lower caves. Such, then, is a brief *resumé* of this cave history and its human and animal relics of ages long since passed. It was during the later cold periods of the glacial epoch that we are now certain that man inhabited the continent of Europe and what are now our islands of Great Britain; when there were no Straits of Dover, no salt waves flowing between Ireland and England. We find now continually, in England and on the Continent, his rude weapons and artificially worked flints in old river deposits or estuarine drifts where rivers have ceased to flow and the salt waves no longer roll. Man was living here in Great Britain in times when you might have sailed above the sites of Worcester and Gloucester, on the waters of the Severn sea. Man was living here in England with the mammoth and the long-haired rhinoceros, and has left his flint implements in caves then haunted by the hyæna and the cave bear, which he visited for shelter or for refuge. Not only so: in France he has left behind him bone ornaments and weapons made of the rhinoceros and reindeer, on which he feasted, and even in some instances he foreshadowed the art of a Landseer by drawing rude sketches of the hairy elephant and the reindeer on the very bones of the animals he had slain and devoured. I could say much upon the vast changes that have come over this portion of the planet we now inhabit since these old men

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lived—how the physical geography has changed, the climate has ameliorated, the vegetation has altered, and how where once roamed the savage in search of the mammoth there now rise beautiful cities, verdant pastures, and noble cathedrals—but I trust I have said enough for you to understand what marvels are unfolded to those who study the former history of our earth. In conclusion, let me tender my thanks to Sir James Campbell and Mr. and Mrs. Scobell for their generous aid, and kindly, undeviating hospitality and sympathy.

The PRESIDENT said that he was sure all present had been equally with himself delighted with the address which they had just heard. Mr. Symonds's addresses were always lucid and profound, and the present address was remarkable above all that they had previously heard from him. They all felt greatly indebted to him, and in expressing their obligations he (the President) would add the request that Mr. Symonds would permit his address to appear first in the *Hereford Times'* report of the day's meeting, and afterwards in the Transactions of the Club. (applause).

MR. SYMONDS, in acknowledging the compliment, expressed the great pleasure which he always felt in meeting the Club, and especially in meeting them there on a spot so full of interest and instruction. It was particularly agreeable and encouraging to meet with people who sympathised with him in his researches, and who were ready to accept the truths of science as taught by the rocks and caves around them.

MR. SYMONDS then led the party to the second cave, and made a few remarks on the zeal and intelligence with which the work had been carried out under his directions by Mr. Robertson, of Whitchurch. From thence a number of the party accompanied him to the lower caves, and some even looked into that which is occupied by a notorious person known as "Jem, the Slipper," whose boast it is that he has lived in the cave for thirty years, and has not washed himself for that period. Most of the company, however, preferred to return to Whitchurch by other routes, through the grateful shade of the woods.

On reaching the Hotel, some little time was devoted to further examination of the fossils from the caves, after which the party resumed their carriages and made the best of their way to Ross. As they passed along, the scenery, always charming, showed richly beautiful in the light of the evening sun, yet it must be confessed that most, if not all, were very glad to reach their temporary destination, and to seat themselves at the dinner table of the Royal Hotel. Geology is good, and fossils are good, and a day in King Arthur's Hall is good also; but then the sun had been fierce, the scenery somewhat obscured with haze, and the fatigues of the way had prepared all to exclaim with John Gilpin's wife—

> The dinner waits, and we are tired!
> Said Gilpin, "So am I."

The wearied philosophers found their hunger assuaged with an excellent dinner, admirably served. After dinner

The PRESIDENT rose and gave the health of her Majesty the Queen, the only

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toast given at the dinners of the Club, but one which loyal Woolhopians never omitted. The toast having been drunk, the President expressed the great gratification which he felt in seeing so large a gathering of members and visitors, and in congratulating them on the very pleasant day which they had spent. They all owed a debt of gratitute to Mr. Symonds not only for his excellent lecture, but also for his explanation of the most interesting exhibition of fossil remains with which it had been illustrated (applause).

MR. SYMONDS, in acknowledgment, expressed the pleasure he felt in being able to illustrate the great truths of geology, and to bring before them evidences of the vast changes which had taken place in this district. He felt that the study of the rocks enlarged the mind, and was worthy of man's intellectual powers. Above all, he felt that it was beneficial to man as a reasonable creature that he should thus learn to understand somewhat of the power and wisdom of the great Creator (hear, hear).

The CHAIRMAN called upon Mr. Flavell Edmunds, as one of the Editorial Committee, to make a Report.

Mr. EDMUNDS said that he had hoped to escape at that late hour, but that he observed a twinkle in the President's eye, which, if not "ominous," was at least intelligible; and it said to him plainly enough, "obey and speak." He had, however, little to report from the Editorial Committee: the printing of the Transactions had been delayed by accidental circumstances, but was now going on. The fourth sheet was nearly ready; and he had no doubt that the book would be completed by the time of the Fungus Foray. For the rest, he would just say that he had been greatly interested and delighted with the eloquent lecture of Mr. Symonds, and with the whole proceedings of the day. This meeting at Whitchurch put him in mind of the first time when the Club assembled there, just 22 years ago. Mr. Symonds would no doubt remember the pleasant little party and their ramble into the adjacent Forest of Dean, and Symond's Yat, investigating the Conglomerate, the Millstone Grit, and the Coal Measures, and gazing with new interest upon the grand landscape, as their late esteemed chiefs, Sir Roderick Murchison and the Rev. T. T. Lewis, explained the broad facts of the history of the strata around them. In the intervening time, their revered friends Sir Roderick and Mr. Lewis had been removed by death; their esteemed founder, Mr. Scobie, had also been snatched away, all too early for the useful career on which he had entered; and few indeed of the party which met in 1852 were now left. A fresh generation, he might almost say, had sprung up in the Club; and he was glad to be able to congratulate Mr. Symonds on the fact that the new generation mustered in so much greater number than the old, although they could not be said to show a greater love for the grand science upon which Mr. Symonds had so often spoken to them. For his own part he was delighted to see that gathering, because he took it as a proof that the truths that day expounded were making their way. He felt that the discoveries of geology were especially valuable in their bearing on the Christian verity. He held that man's conceptions of the greatness of the Christian scheme were raised by the evidence that the creation

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was a grand work stretching over countless ages, and made up of innumerable details all carefully elaborated, and all parts of the great process by which the world was gradually fitted to be the habitation of an intelligent being, capable of understanding the mighty work of which he was the ordained head, and capable of honouring and serving the beneficent Maker of all. The geologic view of creation seemed to him to exhibit the great work in the form worthiest of infinite wisdom, power, and goodness (applause).

The following paper by the Rev. H. C. Key, on a Boulder at Symond's Yat, was taken as read :—

ON A SO-CALLED "ERRATIC BOULDER OF PENNANT SANDSTONE" AT SYMOND'S YAT.

In the year 1870, on the occasion of the meeting of the Woolhope Club at Symond's Yat, Dr. Thomas Wright, F.G.S., drew attention to a large stone to be seen on the private path adjoining, which he pronounced to be an erratic boulder of Pennant sandstone, and upon which he delivered a special address. I was not present at the meeting, and it was not till a year or more afterwards that I read the account of his address in the Transactions of the Club ; my impression had been that the stone in question was mill-stone grit, but I had no opportunity of examining it and the locality carefully till the Club met in the neighbourhood on Friday last, the 17th inst., when, after Mr. Symonds' paper at the Doward caves was concluded, I went, in company with other members of the Club, to Symonds's Yat for that purpose, and the result of the examination, which is by no means unimportant, I now lay before the club.

On pages 50 and 51 of the volume of Transactions for 1870, will be found the following paragraphs, which give the substance of the chief points of Dr. Wright's address :—

"The party then proceeded to the private grounds in the Yat to examine a large boulder of hard yellow sandstone called 'Pennant,' which is here seen resting upon carboniferous limestone, and has been brought into its present position by some powerful agency, for it is clearly a rock mass that has been transported from a distance, there being no such rock as that of which it formed a part in the vicinity of Symond's Yat. . . . . After such an example as the Doctor adduced, it is easy to understand how this block of Pennant sandstone was removed from its original bed to the limestone of the Yat, for, as the whole valley of the Wye affords evidence of glacial action, doubtless this great natural force was the agency by which it was transported thither. This Pennant rock where it now stands is entirely out of its natural position, and therefore was lifted into its resting place by glacial action (applause)."

The ablest and most careful geologists will sometimes be mistaken, and some excuse may justly be made for Dr. Wright's mistake in this instance on the score of his visit to Symond's Yat being so brief and hurried ; he may possibly have accepted his facts on the authority of another, but however that may be, his conclusions respecting this block of stone are unquestionably incorrect.

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1. It is not an "erratic boulder" at all, but merely a weathered block
2. It is not "yellow Pennant sandstone."
3. It does not "rest upon carboniferous limestone."
4. It was not "lifted into its place by glacial action."
5. There is "a rock, of which it has formed a part, in the vicinity of Symond's Yat."

And with regard to the statement, that "the whole valley of the Wye affords evidence of glacial action," I am not aware of any one piece of evidence yet found in the whole course of the Wye valley, which amounts to actual proof of glacial action,—such as that which is seen round Snowdon, to say nothing of the Lake district of Scotland. But even if this were an erratic boulder of Pennant sandstone, and if there were satisfactory evidence of glacial action in the Wye valley, it is not easy to see how ice could have brought it from the Brisiol or South Wales coal-field, across the watershed of the Severn or the Usk valley, to the spot where it now lies. I may add that I much wonder Dr. Wright was not startled at his own conclusion, which, if true, would involve the extraordinary circumstance of a piece of local sandstone being transported by natural agency from one coal-field, to which it is peculiar, to another from which it is absent.

With the able assistance of Mr. F. D. Long, of the Cotswold Field Club, I have ascertained the following facts respecting this well-known stone, and he is able to corroborate the truth of every one of them.

The stone itself is indubitably mill-stone grit, resting on the mill-stone grit formation. The hill above the pathway on which it lies, and the pathway itself, form part of the same formation, which extends to the edge of the steep slope to the river, and descends it for a short distance. The geologists of the ordnance survey have failed to see not only this, but also the more obvious fact that the overlying rock, as you go on to the promontory of Symond's Yat, is of the same formation; and that, when you ascend the furthest part of the promontory, the surface rock is found to be mountain limestone, whereas in the survey maps the whole is marked as carboniferous shale. Still further the road up to the Yat, when it reaches the top of the hill, passes through a cutting in the rock; that portion on the left-hand is mill-stone grit; that on the right-hand is for a short distance limestone, which soon passes into mill-stone grit; at the actual junction it is very interesting to trace the confused way in which the two formations, so distinct in character, are mingled together, a mass of the limestone occasionally overlying the mill-stone grit. The cause of this is apparently due to the fact that the carboniferous limestone which forms the mass of the promontory of the Yat has been tilted up, and dips at a considerable angle (as shown in the the survey) towards the great limestone escarpment (of which it forms a part) which escarpment extends down and overhangs the river for a considerable distance, its bedding being perfectly horizontal; the point at which the bedding of the strata is thus broken and inclined is also the point of junction of the mill-stone grit, and hence probably the crumpled and contorted appearance observable at this spot.

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The peculiarity here presented and the dip of the margin of the great limestone cliffs through which the river takes such a winding course is well worthy the attention of the geologist.

H. C. KEY.

Mr. John LLOYD, jun., of Huntington Court, handed in a very interesting account of the discovery of a gigantic skeleton in King Arthur's Hall, about a century ago, which was taken as read, it being necessary that the company should at once proceed to the station to catch the return trains. We give Mr. Lloyd's communication as under.

THE SKELETON FOUND IN KING ARTHUR'S HALL.

A copy of a scarce book, entitled "The Excursion Down the Wye from Ross to Monmouth," compiled by Mr. Heath, printer, Monmouth, was handed in by Mr. John Lloyd, jun., of Huntington Court. The book was published in 1799. It is interesting, as containing an account of the discovery of what is described as the skeleton of a man of gigantic stature, which was said to have been found in "a natural tomb, under an arch," in the cave called King Arthur's Hall. Just such a natural cave, formed by two large pieces of rock, at the extremity of the left hand passage in the cave, was visited by the party on this occasion, the passage leading to it being, like the other recesses of the cave, lighted with candles for the convenience of the visitors. The hollow enclosed under the natural arch did not suggest the idea of its having been the grave of any man of gigantic stature; but then it was possible that the skeleton lay with the head only under the arch, and the limbs extended towards the mouth of the cave. The description of the discovery of the skeleton seems to have been drawn up somewhat carelessly, the site of the cave being incorrectly stated as at the N.E. edge of the camp on Little Doward Hill, whereas it is on the S.W. slope of Great Doward Hill, and is separated by a deep valley from Little Doward. The cave is correctly stated to be on the side overlooking the town of Monmouth, but as the town lies to the southward of the Little Doward camp, it is obviously impossible that the description could apply to any cave on the N.E. side of the latter hill.

The finding of the skeleton is mentioned briefly by Camden in his "Britannia," but in Heath's work it is given on the authority of a letter by a Mr. George White, of new Wear (an ancestor of Mr. Lloyd). It is admitted by the writer to have been "varyously told," but it is added that "what follows may probably be nearest the truth." The discovery is stated to have taken place in the year 1700. The incident is thus told by Mr. White:

"A poor woman being in search of a goat that annually brought her two young kids, meeting with some woodcutters near the camp, inquired if they had seen her goat, and received information it had been observed going into such a hole near the mouth of the camp, which being somewhat small, the woman desired her informers to break down part to let in more light. I don't know whether the goat was found, but in return something more surprising (by the additional light thrown

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in) presented itself to their view, which was the body of a man of very large stature upon the ledge of the rock, and covered over by a natural tomb, an arch of the same rock. He lay at his length, I think, upon his back with his spear by his side. One of them ventured to touch the body of this once mighty man, and all sunk down in dust. As a strange and acceptable curiosity, the men sought for a basket and carried all the bones and skull to the master, Mr. George White, New Wear. The skull, I have heard, was given to Captain Scudamore, of Kentchurch, always a most friendly countenancer of Mr. White, to whom he sold his woods near Kentchurch, and most cordially wished success. 'Tis said the wooden part of the spear time had mouldered into dust, but the head, which was of brass, was carried down to the master. If the skull was given with the bones to the surgeon, then it must be sent back from Kentchurch. * * * *

"The common account that passeth, of the length of the longest bone of the middle finger and the bones of the leg and thigh, some will judge must needs be magnified when reported to be twice the length of the same bones of a common man, that is 5 feet 8 or 10 inches, which was about the stature of Mr. George White. * * * * * * * * * * *

"Gibson, in his third and last edition of Camden's Britannia, has recorded it that the length of all the joints was twice the length of others of this age. If so, the man must be 11 or 12 feet.

"Mrs. Henrietta Gwillim, upon mention of these things, said she had often and always heard it reported that the hip-bone was the full length of her grandfather's, Captain George Gwilliam's, of Whitchurch, leg and thigh bones; that she had seen it and took the measure—and the captain was a tall lusty gentleman nearly six feet high."

It is to be observed here that the corroboration really contradicts the statement which it was intended to establish. If the hip-bone were only equal to that of a man six feet high, it is obvious that it could not have belonged to a man of double that stature, nor could the longest joint of the middle finger have been "twice the length" of that of Mr. White.

A Mrs. Mary Hopkins and her father, John Llewellin, are also cited as corroborating the story of the discovery, and the latter is stated to have been actually present with the workmen when the body was discovered. They, however, give quite a different version to that attributed to Mr. White. According to them the body was found in a search for hidden treasure supposed to be buried in King Arthur's Hall. In the position of the body, its crumbling to dust, and the gigantic size of the bones, Llewellin fully corroborates Mr. White's account.

Heath's narrative goes on to forestall the natural inquiry as to what became of these gigantic bones, by stating that "the surgeon was intentionally sailing to Jamaica when the ship was cast away, and himself and the bones buried in the sea." Some "further testimony" which he subjoins explains the disappearance of the bones a little more fully, as follows:—"For some time the bones lay exposed on the wall near Mr. White's house, being placed there by him to prevent

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the workmen's children from playing about the house and disturbing him with their noise, after which they were given to Mr. Pye, surgeon, Bristol, whose premature fate we have before recorded," for the professional aid rendered by him to his friend (Mr. White), the only remuneration he would accept of.

Mr. White seems to have conjectured that the bones "might possibly belong to one of Vortigern's officers or great men, who fled from the defeat at the battle of Amesbury, in Wiltshire, and secreted himself for a while in the wood of Doward.

A correspondent of Heath throws a very natural doubt upon the correctness of Mr. White's conjecture. He remarks: "We well know that Vortigern retreated after the massacre at Amesbury into Wales, where he immediately built for himself a castle called Kaer Gwortigern, after his name, and in which he was destroyed: but that Doward was an asylum for any part of his army after that retreat, or that the person here found might have been one of his officers, the histories which record the events of that day will not warrant a conclusion. Might it not rather be deemed after the battle of Ailsford?"

Bishop Usher, in his Ecclesiastical Antiquities, says: "Vortigern was burnt by Aurelius Ambrosius and his army, by applying fire to the town of Genoreu, which lies on the banks of the river Wye, near the town of Monmouth, which still retains its name." The Bishop quotes Geoffrey of Monmouth for his authority. The allusion seems to be to book viii. cap. 2, in which Geoffrey says: "Ambrosius marched with his army into Cambria to the town of Genoreu, whither Vortigern had fled for refuge. That town was in the country of Hergin, upon the river Gania, in the mountains called Cloarius. * * * * At last, when all other attempts failed, they had recourse to fire, which meeting with proper fuel ceased not to rage till it had burned down the tower and Vortigern in it."

Heath mentions a tradition as still current in his time (1799) that King Arthur's Hall extends underground from thence to New Wear, a distance of more than a mile. The present appearance of the cave does not afford any colour for this notion. None of the passages which open into the great cavern or hall extend more than a few yards, while the researches carried on by Mr. Symonds must have laid bare the entrance to any caverns beyond or any passage leading into the interior of the hill.

Heath's conjecture that "the cavern was a mine out of which was produced the iron ore for the furnaces adjoining," the sites of which were at that time marked by heaps of cinders from the imperfectly smelted ore, is probably correct so far as the limestone from the hill may have furnished the flux for the smelting of the ore. But here again the researches of Mr. Symonds show that the cave was used by wild animals not only ages before the comparatively late period when man discovered the art of reducing iron from the ore, but even before man himself was introduced to the earth.

FLAVELL EDMUNDS.

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The botanists had a good day. Among the rarer plants found or observed were the following :—

Carix clandestina, Carex montana, Carex digitata ; Hypericum montanum, pulchrum, androsæmum, hirsutum, and perforatum ; Atropa belladonna, Helleborus fœtidus, Anthyllis vulnaria, Erigeron acris, Serratula tinctoria, Hieracium murorum, Cistus helianthemum, Chlora perfoliata, Erythræa centaurea, Polypodium calcareum (very luxuriant), Melica nutans, Bromus erectus, Tilia parvifolia, Geranium sanguineum, Campanula patula, trachelium, and rotundifolia ; Rubia peregrina, Lithospermum officinalis, &c., &c.

Localities known to produce Hutchinsia petræa, Spiræa filipendula, bee and fly Orchis, Cephalanthera grandiflora, Cynoglossum sylvaticum, and Lathræa squamaria, were visited ; but the botanists were too late to see them.

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Woolhope Naturalists' Field Club.

MEETING AT LYDNEY,

Tuesday, August 18th.

On Tuesday, the members of the Woolhope Naturalists' Field Club held their fourth field meeting for the season at Lydney, Gloucestershire, in compliance with an invitation from the Rev. W. H. Bathurst, of Lydney Park. The President (Rev. J. Davies), the Hon. Secretary (Sir George Cornewall, Bart.), and a considerable party of the members left Hereford by the 9.45 train, and after a pleasant journey of 33 miles, the last 12 of which lay through the most beautiful part of the Vale of Severn, reached Lydney station at 11.50. Here they were met by Mr. Bathurst, jun., who courteously received the visitors, and offered the use of the waggonette which he had brought, to convey them to the Park. The majority of the party, however, preferred to walk, the morning being fine, and the sun's heat being agreeably tempered by clouds. The variety of effects of light and shade given to the charming landscape, the noble river, the grand background of wooded hills, and the quaint-looking little town and its ancient church and cross, helped to make the walk thoroughly enjoyable.

Lydney Park is situated on the junction of the Old Red Sandstone with the Mountain Limestone which walls in the coal beds of Dean Forest, and thus including a variety of soils, must be a happy hunting ground for the naturalist; but as the object of the day was archæological and historical, the hammers of the geologists did not show themselves, and the vascula of the botanists for once returned nearly empty. There was, indeed, no time for either class of investigations, so fully were the party occupied with the consideration of Mr. Bathurst's unequalled collection of Roman relics, and his explanation of the remains of the Roman villa, temple, and camps, in his park, in which they had been discovered.

The day being thus devoted to archæology, the members were guided first to the ancient cross of Lydney, passing on their way by the parish church, which seemed to be noticeable only for its lofty and beautiful spire, and its utterly spoilt lich-gate. The latter, indeed, might be cited as an example of the completeness with which what was probably a picturesque structure may be "translated" into the most hideous and tasteless thing of bricklayers' and plasterers' work. The village cross, happily, has escaped the hands of the repairers and beautifiers of the last century, and remains as the iconoclasts of the 16th century left it, some few

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slight repairs to the steps excepted. That is to say the cross and the shaft which supported it are gone with the exception of a few inches at the base of the latter, but the pedestal with its fine sharply cut tracery and its deeply recessed niches remains uninjured. As there is no trace of any pedestals in the niches, it is probable that there never were any figures. In front of the south niche there are two places where the plinth has been chipped away; and it was suggested that this may have been done to afford room for the supports of a kind of lectern or table. As the cross is of early 14th century work, it was thought probable that it might have been used by the preaching friars, who, being usually on bad terms with the secular clergy, would probably be forbidden the use of the church. As the cross is in the centre of the market place, and as it is raised to a great height (8ft.) by an unusually lofty range of steps, the friar would be able to address a large congregation without inconvenience to himself or them. The Rev. J. Trollope, vicar of Lydney, who was present, and explained the peculiarities of the cross, remarked that there was a fine cross at Clearwell; but the distance (five miles) was considered by the party too great to be attempted in the time at their disposal.

Unhackneyed by tourists, though not exempt from the neighbourhood of tall chimneys, or the shriek of the railway whistle, Lydney Park stands beside the high road from Gloucester to Chepstow, within an easy mile of the town, on undulating ground which skirts the Forest of Dean, and commands a grand outlook on the estuary of the Severn, and Stinchcombe Hill with the vale of Berkeley on the other side of the water. At the ancient seat of the family, soon to be replaced by a modern seat on a most striking eminence, the members of the Club were courteously received by the Rev. W. H. Bathurst and a large party of private friends and guests, amongst whom were Sir James Campbell, Bart., Archdeacon Ormerod (since deceased), the Rev. Stephen C. Baker, and many of the clergy of the neighbourhood. With great forethought and consideration the host had for the nonce converted a very spacious and oblong room into a museum for the relics of ancient Roman civilization, which had been unearthed and collected within the precincts of the two Roman camps, villa, and temple, the remains of which are traceable in the circuit of Lydney Park. Skilfully arranged and classified on tables and in glass cases were to be seen articles appertaining to every department of Roman social life, architectural, culinary, agricultural, decorative; the knives and spoons of the Britanno-Roman period being illustrated as well as their cups, and their more warlike gear. One tray was filled with specimens of the coloured plaster, stencilled in gay patterns, the whites and yellows of which seemed almost as fresh as though just finished, with which the walls were covered. In another were the rusty knives and spoons with which the Romano-Britons ate, and fragments of the vessels out of which they drank—amphoræ, paterœ, vases, bowls, and cups. Another tray contained the keys of their doors, the huge and awkward-looking nails which they used, their staples and bolts, and the hand-bell by which the slaves were summoned. The shape of this bell, flattened at the sides, was exactly that of the larger bell dug up at Marden, in this county, and now in the museum of the Herefordshire Antiquarian Society, in Broad street. Still more

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suggestive was the collection of arm and ankle rings, and portions of chains, such as were put upon captives, refractory slaves, and prisoners. All these were deeply corroded by rust from their repose in the soil during eighteen centuries, but the shapes were perfectly preserved and the material was indisputable. Out-door labour was represented by the iron sickle, the hatchet, and some remains apparently of other tools. The household and the toilet of the families which dwelt at the villa and temple were represented by combs, small tweezers as perfect in action as ever, ornamental pins, headed with agate or sapphire, necklaces or beads (lapis lazuli, &c.) long hair-pins, a great number of rings, both solid and twisted in construction, together with a small toy-bell with four openings shaped so as to represent the petals of a rose. Samples of the combs, tweezers, pins, rings, necklaces, and parti-coloured beads are to be seen in an excellent little hand-book of Mr. Llewellyn Jewitt, F.S.A. (Half Hours among English Antiquities). That the Roman ladies were accustomed to use preparations for heightening the effect of their charms might be inferred from the discovery of three stamps for different kinds of *collyrium* or eye-salve, prepared by a certain Julius Jucundus from myrrh and other ingredients, which were supposed to add to the brilliancy of the eye. Thus Eastern women at the present day stain their eyelashes and eyelids with a preparation which by contrast greatly heightens the brightness of the eye. On two pieces of pottery were female faces, with the hair so elaborately dressed that it might provoke the jealousy of modern artistes; there was however no clue to their identification; though it was remarked later in the day that a female terminal statue at one extremity of the larger camp gave like evidence of no mean skill in the use of the brush and curling irons.

Besides these features in this remarkable Museum, there were noticeable also curious military relics, among them iron spear-heads with rude sheaths for the wooden stock or shaft, well preserved arrow-heads, bosses of shields, and equestrian rings. One of these had a projection on one side perforated in squares like the ward of a key; and in addition to these the numismatic department was well represented by coins of Galba, Hadrian, Antoninus, and other Emperors to Allectus inclusive. But after all these ancient details that which attracted most careful and curious inspection, was a collection of three votive tablets, two in bronze, the third, if we recollect aright, in pewter or lead, all of which bear express reference to the tutilar Romano-British deity, to whom the temple, still traceable within the precincts of the camps is dedicated, and one of them the name of Flavius Senilis the probable founder of the temple, and owner of the adjacent villa. It would seem that this god was named Nodons, Nodens, or Nudens; and there is reason for supposing that he was a local British deity, adopted by the Romans in Britain, after their accommodating fashion, into their tolerant pantheon. In the ruins of the temple was found an inscription in large characters, covering a large space, and, with the exception of one or two inconsiderable lacunæ, easy to decipher. Its surroundings included a fanciful border, representing the twisted bodies of salmon, the fish of the Severn; and cocks, serpents, dogs, and representations of limbs, in connection, it would seem, with

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the Divinity of the shrine. It might be too much to say that this inscription in so many words indicates the object of the building, or establishes the name of the god, to whom it is presumably dedicated. Yet the burden of it, taken in connection with the three votive tablets already mentioned, goes far to settle the question. The inscription runs thus:—

D.A. . . FLAVIUS SENILIS. PR. REL. EX STEPIBVS

POSSVIT O . . . . . ANTE VICTORINO INTER . . . . ATE.

Here the two first letters are in all probability the prænomina of Flavius Senilis, who may well have been owner of the villa, as in the inscription he claims to have dedicated the temple. The abbreviated words PR. REL have been taken to stand for "præses religionis," an ecclesiastical title, for which there is no authority or warranty, whilst it is highly probable that they may more aptly represent the Latin words, "pretio relato," which, taken in conjunction with those next following, viz., "ex stepibus," or, "ex stipibus," would signify that the altar or shrine was paid for by the "penny subscriptions," the small coins paid freely by the votaries at the instance of the priests. There is no lack of illustration of such spellings as 'stepibus' for 'stipibus,' 'possuit' for 'posuit,' and the like from other examples of later Roman epigraphy. In fact, bad orthography is rather a confirmation of a genuine inscription. Dr. Mc.Caul, too, the Principal of University College, Toronto, has parelleled the practice of defraying the cost of sacred buildings among the Romans by small contributions with an extant inscription to Mercurius Augustus in Switzerland. It is to Dr. Mc.Caul indeed and his Britanno-Roman inscriptions that we owe most of our light upon this at first puzzling inscription. From what has been already made out, and the filling up of the lacuna between O and Ante with the letters PVS CVR (h.e. opus curante) a text will have been reconstructed thus translateable:—"Flavius Senis, set up this temple at a cost defrayed by small money offering, Victorinus being the builder, or clerk of the works." Victorinus, it should be noted, was a name not uncommon among the Silures, and it is obvious that we have yet to connect with it in somewise the defective INTER . . . ATE. The most plausible filling up of the 'lacurna' is that of Dr. Mc.Caul, AMN = 'Interamnate,' a word to be regarded as an adjective of place: so that Victorinus will thus be further identified as a local builder, 'Victorinus the Interamnian, or native of a country between two rivers,' "the eye between the Severn and the Wye," of which a later local proverb tells. This adjective of the birthplace is quite classical, for, in Cicero's oration for Milo, one Cassinius, by cognomen Scola, *Interamnas*, an Interamnian, is mentioned. He was of Interamna in the mother-country, not that in the province of Britain.

Against this ingenious restoration militates the fact that the fragment of the first missing letter, which is still visible, is unlike the top of any other A in the temple inscription; but perhaps exact uniformity is no more to be looked for in written characters than strictness of orthography. What makes the suggestion f Interamnate more ingenious, is that it will help to unriddle the puzzle of

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another Interamnate in one of the votive inscriptions on a leaden or pewter tablet, thus :—

NODENTI SILVIANVS DIVO
ANVIVM PERDEDIT
DEMEDIAM PARTEM
DONAVIT NODENTI
INTER QVIBVS NOMEN
SENICIANI NVLLIS
PERMITTAS SANITA
TEM DONEC PERF * RA *
VSQVE TEMPIVM NO
DENTIS.

The gist of this inscription is that one Silvianus wagered a ring : one half (the value of it) he presented or vowed to the god, Nodens, and as a certain Senicianus won the bet, and left Silvianus to pay his vow to the god how he could, besought the deity not to grant the blessing of health to any one of the name Senicianus, till the said ring was lodged by its winner in the god's temple. After *donavit Nodonti* in the inscription follows, *inter* without a customary accusative, but with a relative clause beginning *Quibus Seniciani nomen.* Here some supply *eos* before *quibus :* others take *inter* for *in termino,* referring to a terminal statue of Nodens. But the one explanation is harsh, the other more than doubtful, seeing that the terminal statue hard by has nothing to identify it with the British Æsculapius, and is much more like Pan or Silenus, or a terminal bust of Socrates. If however we might take *Inter* for Iteramnati, on the faith of the other inscription, we have the god's locale, as well as that of Victorinus, satisfactorily identified. The credit of this acute discovery is wholly due to Dr. Mc.Caul. The two other inscriptions which remain are of briefer tenor. They run as follows :

(1)
D M. NODONTI
F. L BLANDINVS
A.RMATURA
V. S. L. M.

or, in English, "Flavius Blandinus, a light armed soldier, readily, as was meet, paid his vow to the great god, Nodens," and

(2)
PECTILLVS
VOTUM QUOD
PROMMISSIT
DEO NODENTE.
M DEDIT.

or, Pectillus, as was meet, paid to the god, Nodens, his promised vow." Such irregularities of orthography as *promissit* NODENTE are very common.

In the garden, Mr. BATHURST pointed out a collection of roofing tiles, the pipes of the hypocaust, and the drainage pipes which had been found at the villa.

After nearly two hours spent in the Museum the party were summoned to luncheon, which Mr. Bathurst had hospitably provided for his guests, who numbered not less than fifty ladies and gentlemen. The repast, which was sumptuously provided, was served early, and was not followed by long sitting at table, the

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members being desirous to see the camps and site of the villa and temple from which the Roman remains had been obtained.

After lunch, the PRESIDENT (Rev. J. Davies) rose and said that he felt it his very agreeable duty, as president of the Woolhope Club, to return thanks to their esteemed host, the Rev. W. H. Bathurst, for his great kindness in inviting them to visit his beautiful park, for exhibiting to them the contents of his most interesting museum, and finally for his thoughtful care for their comfort in the provision of that very excellent entertainment which he had given them (applause).

The Rev. Mr. BATHURST gracefully acknowledged the vote, remarking that he felt the obligation was quite on the other side. He was glad to find that the Woolhope Club sometimes stepped across the borders of their county and investigated parts of the neighbouring counties, and he hoped they would be interested in what he had yet to show them. He felt honoured by their accepting his invitation, and hoped they would find the camps and the villa worth seeing (applause).

The party then rose from the table, and were led through the beautiful gardens into the park, admiring on their way the fine specimens of tropical and sub-tropical plants which were flourishing in the open air. Lydney Park gardens are certainly warm and sheltered, but we did not expect to find the Magnolia, the *Ficus elastica* (Indian rubber tree), not to speak of the oranges in full fruit, in the open air. The mildness of the climate, however, was shown with equal force by the enormous size of the *Castana vesca* (edible chestnut), some of the trees being at least 70 feet high, with trunks measuring 18 to 20 feet round at five feet from the ground. It was noticed, too, that in some cases where a huge branch had fallen to the ground it took root and sent up a fresh set of foliage distinct from the original extremity of the branch, which went on growing and fruiting as if nothing had happened. Among the other remarkable trees, one in the park was noticeable for the curious contrast between the upper and the lower leaves, the former being entire, while the latter were divided and deeply serrated.

It was through the gardens and park that the party made its way to the camps, the larger of which is of an irregular, oblong shape, 830 feet long and 730 broad. It commanded the Severn, and covered some eight acres according to the hand-books. It is single-ditched on all sides but the east, where, as the ascent is less steep, the ditch is two-fold. The lesser camp is round and single-ditched. Within the entrenchments of the larger of the two, lying to the right of an undoubted Roman road, lead to Caerwent, Mr. C. Bragge Bathurst, sometime Chancellor of the Duchy of Lancaster, and a kinsman of Lord Sidmouth, was the first to discover and excavate the remains of a considerable Roman villa or palace, with commensurate offices and adjacent buildings. To summarize a note of Dr. Ormerod to his elaborate paper "on the British and Roman roads leading to Caerwent," read at the British Archæological Proceedings in 1851, "the excavations disclosed the foundations of an irregular quadrangle, the sides of which averaged 200 feet, exclusive of offices to the north-west, and of a palatial fabric on the north-east. This latter had a portico on the west front, and an open court

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in the centre, surrounded by corridors in which, as well as in several chambers occurred beautiful tesselated pavements;" two of which Mr. Bathurst had kindly uncovered for the inspection of the Woolhope Club. To the north of this building, and detached from it, are considerable hypocausts, the system of flues beneath the chamber floors being distinctly traceable, though it would be too much to aver that there is extant proof of these chambers having been bath-rooms. Here, too, are elaborate tesselated pavements, one of which was uncovered as a type of the rest, which have remained carefully preserved by the first excavator, who had the forethought to treasure up the coins and relics found, and to have plans and drawings executed, of no less than eleven tesselated pavements.

We have still to speak of that part of the principal quadrangle most interesting to the classical antiquary, viz., the vestiges of a temple, 95 feet long by 75 feet broad, from which we glean the name of the tutelar god, the inscriptions and votive tablets to whom we have already discussed in the Museum. There can be little doubt that the votive tablets found just outside its walls, in connection with the larger inscription already discussed, and coupled with a brass figure of a dog, and the two figures of winged serpents, identify the god Nodens with Æsculapius, or the God of Healing.

Sir S. Rush Merrick traced the name of Nodens, Nudens, or Nodons to the British 'Noddi,' *to preserve*, or to 'Nodutos,' a rural god, presiding over the "nodi culmorum," and it is certain that at Lydney was a temple to a god of healing, propitiated for his healing powers with typical offerings. But Dr. Mc.Caul ventures another conjecture in reference to his identity with Nodutus, which is entitled to consideration. The circumstance that limbs were here offered, suggests to him the possibility of this god's connection with the cure of diseases affecting the joints or "nodi," and the query whether the same deity may not have presiding over vegetable and animal "nodi." Who shall that a god in charge of the healing of gouty and rheumatic joints may not have been in grave request in the days when the villa and camps at Lydney were occupied by a Roman legion; and the god, Nodens, the deity in such request?

The members having assembled on the camp, near the prætorium, Mr. BATHURST delivered a very interesting address, explaining the history and the construction of the camp and buildings, and pointing out the various spots where the most remarkable remains have been found. He said that he believed that the camp was first formed there about the year 60 or 70, and that in after times, when the Roman domination was fully established, the camp was converted into a station for permanent residences, and that a temple was afterwards added. It seems to have been suddenly destroyed by fire and never restored, but it had then lasted for many centuries. Coins of sixty emperors, from Augustus to Honorius, having been found there, it would follow that the station was not destroyed until the break-up of the Roman Empire. It is not mentioned by any ancient writer; and indeed it became entirely forgotten until the commencement of the present century. The estate had been granted by Charles II. to the Winter family, in whose time excavations had been made in several parts of the camp in search of

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iron ore, but no one seems to have thought of the edifices under which the miners worked. The neighbours, however, were allowed to remove portions of the masonry which appeared above ground, and to use them for building walls. In the early part of the present century the estate had come into the possession of his (Mr. Bathurst's) family; and his father had taken the pains to explore the ruins, Mr. Bathurst showed a series of maps and plans which had been prepared, and remarked that the measurements were all carefully made. As soon as a bit of wall was cleared of earth, its position and dimensions were ascertained and set down on the plan. The immediate cause of this survey and excavation was the revealing of a bit of tesselated pavement in consequence of the fall of a wall. It was remarkable that in all their excavations they had found no trace of a burial place. Their reasons for supposing that the building marked "C" on the plan was a temple, were, that they found there the votive tablets which the company had seen, and the inscription on the tesselated pavement. (He then described them minutely, giving at length his reasons for reading the contractions as he did). He remarked too, that a figure of a human leg had been found, which was not part of any statue, and which seemed to have been hung up in the temple as an offering from some person who supposed that his diseased leg had been cured by the interposition of the god worshipped there. It was customary to hang up models of limbs and other parts of the body in the temples of Æsculapius, and this fact went to strengthen the arguments that that god was identical with the Nodon of the votive tablets.

The PRESIDENT remarked that this practice was still kept up at St. Winfred's well in Flintshire.

Mr. BATHURST went on to say that there was a great difficulty attendant upon this interpretation. There was no such god as Nodon found in the Roman mythology; the nearest name was that of Nodatus or Nodutus, the god who presided over the swellings or knots in the corn, but he was altogether too insignificant to have a temple erected to him. Sir W. Drummond had thought that the name Nodon might be derived from the Greek Nodunos, assuager of pain, a title which have been given to Æsculapius, although it is not stated that he was ever so called. The frequent recurrence of the figures of dogs, as well as the two serpents, was thought by Dr. Mc.Caul, of Torronto, to make the proof conclusive, but he, (Mr. Bathurst) knew of no reason for supposing that there was any connection between Æsculapius and the dog, except that Pausanias, an ancient Greek writer, states that in the temple at Epidaurus there was a figure of a dog sitting beside the deity. Dogs were not sacrificed to the healing gods, but cocks and goats were. Only one figure of a cock had been found, and that seems to have been made for some use, as it bears upon its back a socket. Mr. Bathurst went on to describe the collyrium stamps mentioned above, remarking that Mr. Wright in his work, "The Celt, the Roman, and the Saxon," had mentioned several, although not those found here. The collyrium mentioned in these stamps was said to be made in one instance from *stacte*, or myrrh; in the second from an oil extracted from

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the quince; and the third from *penc*, a contraction of *penicillus*, a sort of sponge mentioned by Pliny as used to relieve the tumours of the eyes.

Mr. FLAVELL EDMUNDS, at the request of the President, expressed the obligations of the members to Mr. Bathurst for the admirable address which he had given them, and for the pains he had taken to identify and explain the various parts of those most interesting remains.

Mr. BATHURST acknowledged the compliment; and after rambling about the park and its antiquities for a short space further, a small party of members made an excursion to the Scowles, the vestiges of the old Roman mines and iron-works which bear the same name, near Coleford and Bream. A writer on Dean Forest regards 'Scowles' as a corruption of the British word Crowl-leaves, but it is better with Thomas Wright to give it up, unless it have any connection with the verb to "scowl," in its sense of "looking red and hot."

After the proceedings on the camp, the party descended the hill, feasting their eyes upon the beauties of the forest dells, the hanging woods, and the silvery rills which wind through the shades, examining the grand old patriarchal trees, and quitting these delights only for the grand views of the broad Severn and the distant hills lighted up with the golden radiance of summer eve. As they took leave of their kind host, and left Lydney on their return to Hereford, they unanimously declared that they had spent an exceedingly pleasant and instructive day.

We noticed present—Rev. James Davies, President; Dr. T. A. Chapman, Vice-president; Rev. Sir G. H. Cornewall, Bart., Hon. Sec.; Mr. Edwin Lees, President of Malvern Club; Mr. Flavell Edmunds, F.R.H.S.; Rev. W. H. Bathurst, Lydney Park; Sir James Campbell, Bart.; Mr. Charles Bathurst and Mrs. Bathurst; Colonel Byrde; Rev. H. Cooper Key; Mr. Richard Hereford; Rev. Robert Hereford; Mr. Henry Greenham; Mrs. Willesford; Rev. E. Evans, Lydney; Rev. J. J. Trollope, Lydney; Rev. J. F. Gosling, Bream; Archdeacon Ormerod, Sedgeley Park; Mr. F. Adams; Mr. C. H. Moore; Mr. H. G. Apperley; Mrs. Jones, Nass; Rev. A. D. Pringle, Blakeney, Newnham; Lieut. Symonds; Mr. William Symonds; Mr. R. B. Davies; Mr. Arthur Thompson, Treasurer and Assistant Secretary.

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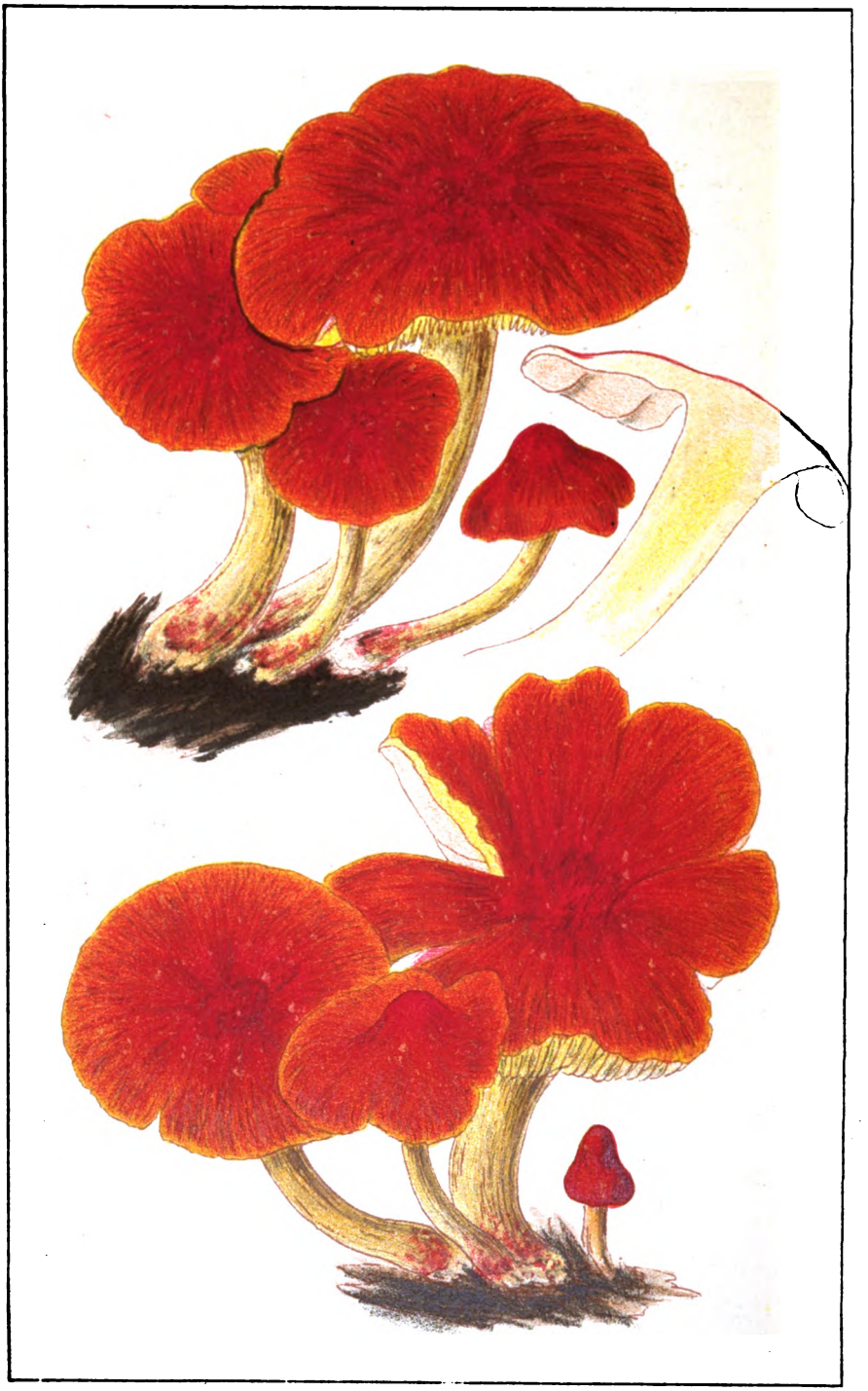

AGARICUS LEONINUS. FR.

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HEREFORDSHIRE FUNGUSES.

AGARICUS (PLUTEUS) LEONINUS, SCHÆFF.

SCARLET VARIETY OF YELLOW PLUTEUS.

This very beautiful species, which is usually of a tawny yellow, shaded with bright orange, or occasionally tinted with purplish brown, was first found by Miss Maude Bull, growing in crowded clusters, within the hollow of a decayed Elm trunk in 1874, in Hinton Lane, near Hereford, and it continues to appear there in more or less abundance annually to the present time, 1879.

Description.—Pileus, 1-3 in. broad, unbonate, companulate, and then expanded, sometimes pitted round the umbo, smooth, submembranaceus, with a striate margin, variable in colour but usually with bright yellow orange tints. Stem, 2-3 in. high, solid, smooth, striate, downy at base, sometimes rooting, orange tinted, but here with scarlet tints at base. Gills, free, broad, yellowish, then flesh coloured, rounded behind and in front. Spores, rose coloured, elliptic. *Schæff, t. 48. Fries' Epicrisis, 188. Pers. ic. et desc, t. I., f. 3-4. Berk. Out., t. 7, f. 4. Engl. fl., V., 78. Cooke's Handbook I., 88. Cooke's Grevillea, Vol. VI., pl. 93.*

The colour of the pileus was too brilliant to be represented accurately. This variety has not as yet been found elsewhere.

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Woolhope Naturalists' Field Club.

THE ANNUAL FUNGUS FORAYS.

It might have taxed a clearer and stronger brain than that of "Our Own Commissioner" to keep count of and carry in his head the records of the Woolhopian Fungus hunts, which came off in the first week in October, through the exciting week which immediately followed, and during which all Hereford, except himself, must have held high festival on account of the opening of the Free Library. But the great firm of "Method and Pluck" can do a great deal, especially when the junior partner pulls the strings, and therefore we are not surprised that after a short breathing space he has found time to put together notes, which, had they been sent in last week would almost certainly have been "crowded out," but which, coming now in the hush after a great excitement, will be welcome not only to the foraging parties, but also to a goodly number of their stay-at-home and weather-bound friends.

The opening muster of the mycologists proper, took place on Tuesday, the 29th of September, and a select band—consisting of Dr. Bull, Mr. Broome, Rev. W. Houghton, Mr. Lees, Mr. Morris, Mr. Plowright, Mr. Renny, and Mr. Phillips—arrived at Ludlow by the early trains *en route* for the beautiful grounds of Downton Castle. The party was hospitably entertained at the Abbey Villa, Ludlow, by the Messrs. Fortey, whose welcome to the Club some years back when it explored Deerfold is still held in pleasant remembrance, and these gentlemen presently reinforced the excursionists with the addition of themselves to its number. Arrived at Downton the foray began under the leadership of Dr. Jones. The fame of the "gorge of the Teme" for its lovely scenery is world-wide. The river rushes through a stony channel, now broad and rippling, and again contracted, deep, and silent, whilst its banks are fringed everywhere by the richest variety of woods. For a full mile's space a charmingly meandering walk transports the lover of nature at one time to the river level in deep gloom from rock and foliage, and another, in prospect, to some lofty craig, where—

> "Midst scatter'd trees the opening glade
> Admits the well-mixed tints of light and shade."

It is indeed a lovely valley, though not for its loveliness was it visited on this occasion. Other attractions were potent enough to draw from north and south, east and west, the eager excursionists of the day. Listen, scoffers of science! Here is the only known British home of the brilliant coloured *Cortinarius*, (Dermocybe,) *cinnabarinus*, and of the *C. Miltinus*, and here, too, in favourable years

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grows abundantly the rare fir-cone Boletus, *Strobilomyces Strobilaceus*, while on its mossy banks and promontories are to be found other funguses rare and interesting. Think of this, and shake off the scales of your mental obfuscation!

At the Castle Bridge on an elm branch a fine *Agaricus Pleurotus ulmarius* was observed and gathered successfully. Though abundant in the parks and neighbourhood of London it is rare in Herefordshire, so that we may as well note that it is pleasant and said to be edible. We should suspect it would need a power of stewing to make it tender. Almost at the entrance of the walks the foragers were encountered by a heavy storm of a full hour's duration, which, however, did not stop the hunt or damp the enthusiasm of the hunters. *Marasmius fœtidus* gladdened their hearts, however much it might offend their noses, and its sister *Marasmius erythropus* was pleasant to their visual organs. Why will people keep sniffing at things unpleasant when they know what to expect? At Downton the sweet-scented *Lactarius Glyciosmus*, *Agaricus* clitocbe *odorus* and *fragrans* were at hand; and so, too, in plenty was *Ag.* (Hebeloma) *pyriodorus*, which has a strong odour of pears beginning to ferment, so that savours more agreeable or less disagreeable, as the taste may incline, were not wanting. On a charcoal bed—a "charking place," in the woodman's vernacular—one of the most graceful and beautifully coloured forms of the variable *Ag.* (Omphalia) *pyxidatus* delighted the eyes of the fungologists, lifting away the depressing influence of the rain, which was just then at its heaviest. Ordinary mortals may be afraid of rain: a fungologist has but to retreat under sheltering rock or tree, and wholly forget its importunity in the contemplation, as in this case, of the rare *Peziza succosa*, or the peziza-like *Solenia ochracea*, not to mention Lactarii, Cortinarii, Boleti, and Hygrophori growing all around in the utmost profusion and variety.

After a short halt in the rustic arbour at the Mill (which it was pleasant to see at work), to admire the lofty rocks, and to sketch a picturesque and many-headed boll of a Wych elm, the way was taken up the highest walks to "Renny's Promontory," a name perhaps not of local significance, yet henceforth never to be forgotten in mycologic lore. It is a high, moss-covered promontory, thinly studded with trees, moist, though well drained, damp, and yet airy, a very paradise for funguses. To see them in a favourable season covering the ground here is a sight to remember. Rare funguses affect the spot. It was here in 1872 that Mr. Renny discovered the brilliant *Cortinarius* (Dermocybe) *cinnabarinus* growing in clusters, each richer and more dazzling than its fellow, just gathered; a bright orange vermillion in colour with a metallic lustre that defies water colours to imitate. Here, too, in the following year Dr. Bull found the *Cortinarius Miltinus*, equally new to the British Flora, though by no means so striking in colour or form. The season of 1874 has been so dry and unfavourable that finds were scant on this occasion. The Rev. W. Houghton was the first to find *C. cinnabarinus*, and a cry of joy quickly summoned his co-mates to admire its lovely tints. Smaller groups were afterwards found, and so the day's foray was a success. True, *Strobilomyces strobilaceus* was not found, though keenly searched for. It is clear that it does not like dry seasons. But many other interesting varieties yielded themselves to the

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quest of lynx-eyed foragers, *e.g.*, the pretty and not common *Ag.* (Amanita) *Mappa*, the rare hedgehog puff-ball *Lycoperdon echinatum*, *Coprinus Picaceus*, *Ag. Nanus*, *obscurus erminеus*, *unicolor*, &c., &c.

A stroll was taken on the slopes of Bringewood Hill to search the open ground and examine some curious trees, but, as time was nearly up, the note of recall was sounded, and at the rendezvous of the Castle Bridge a beautiful group of *Ag.* (Pholiota) *heteroclytus* was gathered by Mr. Broome from the roots of a Lombardy poplar. Here a pleasant and welcome hamper turned up, and anon the tired visitors were *Fortey-fied* and refreshed with the Melton pie, chicken sandwiches, and sparkling Carlovitz, which formed its contents. The journey back to Ludlow by Oakley Park and Bromfield Church was singularly bright and cheerful, and this not entirely through pleasant memories of the Carlovitz; for the sun shone out again to give the climax of its warmth and cheerfulness to the satisfaction of a good day's work. At Bromfield an ample supply of *Marasmius oreades* and of *Lactarius deliciosus* was secured for the next day's feast, and so, with laden baskets, the excursionists caught the return trains, alter a foray very pleasant and satisfactory, the rain notwithstanding. Though the fungus season in Herefordshire is confessedly unfavourable, upwards of a hundred different species were observed in the excursion of September 29th.

The foray for Wednesday was fixed for Dinmore Hill, a locality which had proved so rich and fruitful in former years (see transactions of 1871) that it was deemed advisable to revisit it on the bye day. Nor was the idea a bad one, for many interesting plants rewarded the visitors. The rare *Ascobolus viridis*, *Ag.* (Collybia) *Plexipes*, *Peziza repanda*, and *brunnea* were found. The Sphœria, *cordiceps alutacea*, which is very rare, and usually, if not always, in company with *Spathularia flavida*, was also welcomed. Three specimens of *Ag.* (Leptonia) *uchrous* also fortunately yielded themselves to gathering—an agaric, as its name imports, of singular beauty, with lovely tints of violet, varying as the light falls upon it. This has not before been observed in Herefordshire. Here, too, was found *Hygrophoros murinaceus*, a great abundance of *Ag.* (Naucoria) *cucumis*, and many other very interesting fungusses.

During the night preceding the grand field-day of the week, and following the novel introduction into the dinner *menus* of certain hospitable mansions of "Salmi de Lycoperdon gigantum," "Salmi de Lactarius Deliciosus," and a sauce for cutlets of Marasmius Oreades, on the evening of the 30th, the clouds dropped water to the extent of an inch and a-half, and there were grave doubts whether the foray to Stoke Edith would come off. Hopeful members—up and doing with the day dawn—were fain to occupy themselves at the tables, on which the fungi were arranged for exhibition at the Green Dragon, and to postpone a decision until 9.15 a.m., when, an adjournment having been moved to the street, it was found to be still raining at 9.30. Adjourning again to the Barr's Court Station at 9.45, their faith and patience were rewarded by a brightening sky, and, though occasionally the clouds lowered, and the night's rain had made the atmosphere cold and the ground slippery and treacherous, a very pleasant day requited those who had the

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courage to venture. Some five-and-twenty repaired to Stoke Edith by train, where they were joined by the President (the Rev. James Davies), who had been kindly accommodated with a seat in Miss Guthrie's carriage, in which were Miss Guthrie herself, Mrs. Lloyd Wynne, of Coed Coch, and Mr. Washington Jackson. The noble owner of Stoke Edith, Lady Emily Foley, had most considerately placed her head-gardener and head-keeper at the services of the forayers, and thus the delays arising out of defective and speculative guidance were pleasantly minimised. The short grass of the shrubberies was, as usual, excellent hunting ground; but the most favourable finds of the day were as follows:—The rare yellow *Hygrophrus Chrysodon*, showing clearly its colours on the slightest bruise; a great profusion of *Ag.* (Armillaria) *mucidus* on the beech-trees, in a larger and finer condition than is often seen, the larger specimens being from four to six inches across; a lovely segment of a circle of the Fly Agaric *Ag.* (Amanita) *muscarius*, too beautiful not to be commemorated; and a very curious *Amanita*, not fully grown, which puzzled the experts to discriminate and determine. It might be a young giant of a *Vaginatus*, but the scales were not right, nor was its edge sulcated. Or it might be a young *Strangulatus*, or *Excelsus*. A nut for the mycologists to crack! An eye must be kept on the spot for future examination. Here also, as on almost every foray, was found the interesting *Hygrophorus Calyptræformis*, nowhere, however, in great abundance.

To those who joined the excursion to Stoke Edith, albeit on a day little favoured by sunshine, there were several other attractions, scarcely secondary to the prime motive of fungologising. The flower-garden, geometrically arranged by Nesfield, is as perfect a thing as can be seen in a long day's survey of parks and gardens. It is oddly brightened, too, when the bloom is yielding to the early frosts, and spiteful winter forecasts its shadows—by the bright red cloaks of the women who weed the gravel-paths of varied shape and colour. Beyond its precincts, up a succession of undulating slopes, stretches an ample deer park, magnificently timbered, and reaching up to the lofty ridge of Seager Hill, whence a carriage drive commands a grand and extensive outlook of the valleys and hills of Herefordshire, Gloucestershire, and South Wales. Beneath it, southward, lies the Woolhope country, which seems to say to the Club followers, whom it has christened, "Antiquam exquirite matrem." For the mansion itself, its hall, library, pictures, and tapestry—the last exceedingly curious and well worthy of minute inspection—our readers may refer to the "Mansions and Manors" of the President-Elect. Our space at present admonishes us to take wing, in thought, for Hereford, where—despite the charms of Stoke Edith—a committee meeting awaits the President of 1873 and 1874, to say nothing of the feast and the presentation, which attract as great an interest for many as the forays. These have been already reported elsewhere, and it needs but that we should glance at the treasures of the Fungus Exhibition, which graced the sideboards of the Green Dragon guest-chamber—for ornament, let it be added, in more instances, than for edible use. Amongst these we noticed specimens of the *Ag. Mucidus*, measuring half an inch more than the largest of those at Stoke Edith; and a splendid sample

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of the lovely *Peziza Aurantia* (8½ inches across)—sent from Shobdon by Lord Bateman. Mr. Houghton exhibited from the fir plantations of Chetwynd Park, where he has found them year after year—failing last year only—a good specimen of *Sparassis crispa*. Dr. Chapman contributed from the pastures about Hereford a magnificent group of *Ag. (Volvaria) Gloiocepholus*, each agaric being ten inches high, with pilea 17 or 18 inches in circumference. The odour of them is not nice. Near these also was *Agaricus Junonius*. Mr. Berkeley had sent *Leotia circinans*, received by him from Scotland; and from Abergavenny Dr. Mc.Cullough had brought *Lactarius controversus*, on which he alighted the next day growing, abnormally we should say, under a Lombardy poplar. *Radulum Fagineum*, *Lactarius Vitellinus*—which Mr. Worthington Smith declines to recommend as edible, however fond of veal some non-Woolhopians may be—and one or two other somewhat rare plants excited and satisfied curiosity. Amongst exceptional contributions to the Fungus Exhibition were a fresh water sponge from the River Teme, sent by the Messrs. Fortey, and some gigantic rhizomes of the water lily, brought by Mr. William Phillips. Amidst this class—had it not miscarried—would have been exhibited a splendid box of the choicest pears of English growth, sent to the President by Mr. Richard Doddridge Blackmore, M.A., of Exeter College, Oxford, poet, novelist, and market gardener. They might have taught the visitors to the Green Dragon to discriminate between the Beurries and the Doyennes, Louise Bonnes and Marie Louise—and distracted the lovers of fungus forms by the weightier claims of pomology. But, though sent to Reading, carriage paid, on the 28th of September, they did not reach the President's post town, Kington, till the 6th of October, so that they never reached the show, and the President bids us say that all who would discuss their merits must come to Moor Court, and be quick about it, as they are inclining to that condition which gives its name to the Pyriodorus, above mentioned. The feast, and the soirée which followed it, were as successful and cheery as their predecessors; and what, between the presence of ladies and the festive board, an unanimous delight in the unfeigned surprise of Mr. Worthington Smith at the recognition of his constant services, a pleasant memory will long invest the evening of the 1st of October, 1874.

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THE FUNGUS FORAY, AND MEETING AT HEREFORD,

OCTOBER 1ST, 1874.

The Fungus Foray and meeting was held on Thursday, October 1st. There was a good attendance, the following members and visitors being present during the day:—Rev. James Davies, president; T. Algernon Chapman, M.D., vice-president; Mrs. Wynne, Miss Guthrie, Mrs. Cooper Key; Mr. C. E. Broome, Mr. James Renny, Rev. Wm. Houghton and brother, Mr. C. B. Plowright, Mr. Wm. Phillips, Mr. Worthington G. Smith, Mr. Edwin Lees (president of the Malvern Field Club), Mr. R. M. Lingwood, Mr. Flavell Edmunds, Rev. H. Cooper Key, Mr. Thomas Cam, Mr. C. G. Martin, Mr. J. G. Morris, Dr. Bull, Mr. Elmes Y. Steele, Mr. J. J. Merriman, Mr. F. W. Herbert, Dr. M'Cullough, Mr. John C. Kent, Major Merriman, Rev. George Herbert, Colonel Litchfield, Mr. Thomas Walker, F.L.S., Tunbridge Wells; Mr. Jackson, Mr Richard Hereford, Mr. W. A. Swinburne, Mr. H. C. Moore, Mr. Evan Pateshall, M.P.; Lieut.-Col. Symonds, High Sheriff; Rev. Wm. Jones Thomas, Rev. A. G. Jones, Rev. J. E. Jones-Machen, Mr. J. H. Wood, Rev. Arthur Young, Marston; Mr. J. Bowle Evans, Byletts; Rev. T. T. Smith, Rev. J. H. Jukes, Mr. J. Greaves, Mr. T. Clifton Paris, Mr. John Calcott, Mr. Thomas Blashill, Rev. R. H. Williams, Mr. J. F. Symonds, Rev. W. P. Stanhope, Rev. J. A. Panter, Mr. Theophilus Salwey, Mr. Arthur Thompson, treasurer and assistant-secretary,

The following were elected officers for 1875:—

President:—The Rev. C. J. Robinson, Norton Canon, Weobley. Vice-Presidents:—Mr. B. Haigh Allen, Clifford Priory; Rev. Samuel Clark, Eaton Bishop; Rev. E. Du Buisson, Breinton; Mr. F. W. Herbert, Credenhill Park.

Central Committee:—Mr. Thomas Cam, Mr. T. Curley, Mr. John Lloyd, Mr. C. G. Martin, Mr. J. G. Morris.

Editorial Committee:—Rev. J. Davies, Rev. C. J. Robinson, Rev. Sir G. H. Cornewall, Bart., Rev. Samuel Clark, Mr. Flavell Edmunds, Mr. James Rankin.

Honorary Secretary:—Rev. Sir G. H. Cornewall, Bart.

Treasurer and Assistant-Secretary:—Mr. Arthur Thompson, Hereford.

The following gentlemen were unanimously elected honorary members:—Rev. M. J. Berkeley, Mr. C. E. Broome, Mr. James Renny, Rev. William Houghton, Mr. C. B. Plowright, Mr. William Phillips, and Mr. J. Bowle Evans, The Byletts, was elected an annual member.

The meeting was held at the Green Dragon Hotel. The PRESIDENT (Rev. James Davies) rose and introduced the next business of the evening, which he was

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sure would take no one there by surprise, unless it was, as he hoped and trusted, the person most concerned. As he had been in communication with most of his hearers on the subject, he might at once dash *in medias res* and state that some three weeks ago a happy thought occurred to Dr. Bull (who, with his usual kindness, admitted him into the partnership of it) that the club ought no longer to leave unrecognised and unacknowledged the great and gratuitous services of Mr. Worthington G. Smith as its "Mycological Professor," and as one who was ever ready to assist their studies with his pen, his pencil, and his head. Among the literary men he (the President) had met there were two prominent types, the hoarders of their knowledge, who lived in dread of "a chiel among them takin' notes," and the generous and unselfish communicators and diffusers of the information which they had amassed by patient inquiry. One example of the latter type was the late Sir George Lewis: another, in his way and walk of science, was Mr. W. G. Smith. Every Woolhopian knew he could count upon the free use of Mr. W. G. Smith's experience, and of his very extensive and accurate information. Having himself realised this during his two years presidency, he (Mr. Davies) readily undertook to co-operate with Dr. Bull in sounding the members of the club, by letter or word of mouth, with reference to a testimonial, marking the sense of their gratitude and indebtedness; such testimonial to take the form of silver forks and spoons. The result of their canvass had been an unalloyed success. There had been two ghosts of an alloy, but they vanished almost on the instant of appearance. One gentleman began a letter by denouncing testimonials generally in the strongest terms, but went on in the second page to say that were his objections multiplied an hundredfold, he could still rejoice in the privilege of having had the opportunity to mark by a subscription his great sense of Mr. W. G. Smith's deserts. Another sent a subscription with a letter full of complimentry expressions, and concluded with a hope that the forks and spoons might never assist Mr. Smith in conveying to his mouth poisonous fungi, which might terminate his career of usefulness. The thought might cast a passing shadow, but reflection told him (the president) that if there was a man in Europe who could be trusted to discriminate between edible and inedible fungi, that man was Mr. Worthington Smith. In token of their sense of his helpfulness in extending this discriminative knowledge, as well as of their regard and good-will, the Club had deputed him on this occasion to present to Mr. Smith the oaken-box, which he held in his hands, with the plate which it contained, and he begged him to accept it, to quote the language of the superscription, "in pleasant memory of fungus-forays, assisted by his experience, illustrated by his pencil, and chronicled by his pen."

Dr. BULL then rose, and, after playful allusion to the relative shares of the President and himself in originating this testimonial—a mystery, like the origination of the Franco-German War—went on to say:—The pleasure of the correspondence has also been shared by himself, for it was indeed a great pleasure to read the cordial, kind letters received from the members applied to; and, when the lithographed circulars were sent out by our President, every post might be said to bring in a fork or a spoon, until our friendly gift—originally small in our

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ideas—had become really a valuable one. Everyone felt that it was a present really deserved from our Club; and it may be said, without hesitation, that this feeling will be echoed far and wide through the country. Our Club has done itself honour in giving such kindly expression to their obligation; and all those who have written to Mr. Smith from all parts of the country, asking the names and other information about funguses, will know how worthy Mr. Smith is of it. Not to mention the time and patience he has given to all applicants—strangers as well as friends—it must have cost him no small sum in postage stamps alone to reply to them. Our President has not told you how useful that mystical individual, "Our Own Commissioner," was to us. He set to work at once, ornamented the inscription plate with funguses, and sketched out a design for engraving on the lid of the box. There was not time to carry all this out! but he insisted—and I fully agree with him—that every fork or spoon, in place of crest, should bear a fungus on its handle—each a different one, and all of them to be copied from the plates published in our "Transactions," or to represent the funguses new to Britain discovered by our Club; so that the friendly, pleasant days he has passed in Herefordshire will be always recalled to him as his eye falls on a *deliciosus* spoon, or a *procerus* fork, and a kindly feeling will pervade his domestic every day life (applause).

Mr. W. G. Smith, who was warmly applauded on rising, said there was one thing which he never could do, and that was to make a speech, but he felt this inability all the more on that occasion, when he was surprised with such unexpected kindness. He had been thinking only that day how much he was obliged by the unvarying attention and courtesy shown to him in Herefordshire, and he really felt that it was he who ought to make a presentation to the Club rather than the Club to him. He could only add that he prized their splendid gift very highly, and should always feel himself greatly indebted to their kindness (applause).

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HEREFORDSHIRE FUNGUSES.

AGARICUS (FLAMMULA) ALNICOLA, Fr.

THE ALDER FLAMMULA.

This plant is very variable. It grows in clusters from the old trunks of alder, in damp, leafy woods.

Description.—Plant, grows in crowded clusters. Pileus, 2-3in. broad, fleshy, plano-convex, moist but not viscid, irregular in margin, subfibrillose at first, becoming smooth but variable, of a yellowish brown colour. Stem, 2-5in. long, stuffed becoming hollow, more or less curved and flexuose, usually narrowing towards the base, fibrillose, first yellow, then of a red ferruginous colour. Gills, broad, rounded, or slightly decurrent, of dull yellow colour becoming ferruginous. Spores, rust coloured. Taste and smell, bitter. A variety of this plant grows upon willow, and is called *salicicola;* usually of a greenish yellow colour, more squamulose, and irregular in growth, often resembling in appearance Agaricus (Pholiota) auricellus.—*Fries' Epicrisis, p. 248. Fries' Hymen. Succiæ I.. 356.* S.M.I., p. 250. *Quelet, p. 233. Berkeley and Broome, 1242. Cooke's Grevillea, VI., pl. 90.*

This drawing was taken from specimens sent to the Woolhope Club in 1875, by Mr. Worthington G. Smith, from Epping Forest.

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AGARICUS ALNICOLA. FR.

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PRESENT of PLATE from the Woolhope Club

TO

WORTHINGTON G. SMITH, Esq., F.L.S.

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PRESENT OF PLATE FROM WOOLHOPE CLUB

TO

WORTHINGTON G. SMITH, ESQ., F.L.S.

Balance Sheet.

RECEIVED.

		£	s.	d.
22	Subscribers at £1 1/-	23	2	0
7	Ditto at £1	7	0	0
16	Ditto at 10/6-	8	8	0
11	Ditto at 10/-	5	10	0
16	Ditto at 5/-	4	0	0
5	Ditto; 1 at 3/- and 4 at 2/6-		13	0
77				
		£48	13	0

EXPENDITURE.

			£	s.	d.
Lithographic Circular				12	6
Bezant—Silver Plate, 47 pieces ...	£39	8 0			
Oak Box, Silver Plate, and Inscription	£3	3 0			
Less 11/, discount			42	0	0
Tripod Cream Jug in border			2	0	0
Engraving Fungus on plates			4	0	6
			£48	13	0

Hereford, Nov. 9th, 1874.

HENRY G. BULL.

Examined and approved,

JAMES DAVIES, President.

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LIST OF THE PLATE

PRESENTED TO

WORTHINGTON G. SMITH, ESQ.,

BY THE MEMBERS OF THE

WOOLHOPE NATURALISTS' FIELD CLUB,

October 1st, 1874.

Double Thread Pattern	large Forks		8
,,	,,	small Forks	8
,,	,,	Dessert Spoons	8
,,	,,	Table Spoons	6
,,	,,	Tea Spoons	12
,,	,,	Salt Spoons	4
,,	,,	Sugar Nippers	1
Tripod Cream Jug			1
			48

Inclosed in Oak Box with Silver Plate, bearing the Arms of the Club, and this inscription :—

"PRESENTED BY THE MEMBERS OF THE
WOOLHOPE CLUB,
TO
WORTHINGTON G. SMITH, ESQ., F.L.S.,
IN PLEASANT MEMORY OF
FUNGUS FORAYS,
ASSISTED BY HIS EXPERIENCE,
ILLUSTRATED BY HIS PENCIL, AND
CHRONICLED BY HIS PEN."

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On the morrow, October 2nd, when the majority of the Woolhopians had gone away, nothing damaged by the fungoid soups and salmis, to their own homes, a staunch and privileged section set out in a coach and four for Garnstone Park, the seat of Major Peploe, M.P. Frequent storms of driving rain were borne with the more equanimity by the outside passengers, because occasionally, when these lulled, the country to the left of the Hereford and Kington road with the hills that bound it came out splendidly. Mycologists, as has been earlier remarked, don't mind weather; and the drive came to its end with a quickness which surprised the coach passengers, and spoke volumes tacitly for the pleasantness of the company, which consisted of Messrs. Broome, Plowright, Lees, Phillips, Drs. Mc.Cullough, Bull, and Chapman, Mr. Greaves, Mr. Griffiths Morris, the President, and one or two others. At Garnstone the party alighted in front of the modern castellated mansion, built by Nash, and were welcomed cordially by its hospitable proprietor. No time, however, was lost in beginning operations, though at times an umbrella or the shelter of a tree were necessities to the most ardent. The lawns and gardens were first inspected, with an eye primarily to rare funguses, but not without an interest in the Horticultural features which distinguish them. The flower garden is effective and uncommon; but the chief thing to note at Garnstone—in the lawns and outside of them—is the fine growth both of conifers and deciduous trees, which have evidently a very congenial soil and a life entirely to their mind. Visitors of abori-cultural tastes could not help lingering behind the foray-party to note the Piceas and Pines, Cedars, and Junipers of rare sorts, and speculating on the future of a thriving young Picea Bracteata, or admiring the grace of a Pinsapo or Nordmanniana. On the croquet lawn—to return to our chief quest—were found three small rings—and very perfect rings, too, some two feet in diameter—of *Hygrophorus Russocoriaceus*, scenting the air with a scent as of Russia leather. Hard by them Mr. Renny found a fungus new to Great Britain, *Ag.* (*tricholoma*) *Lixivius*, a very interesting plant. Before quitting the lawn for the deer park the hunters came upon *Clavaria rufa* and *Hygrophorus Colemannianus* in abundance, and in the entrance of a small out-building, which need not be particularised, was pointed out a rare instance of Coprinus domesticus. Then the mycologists at length broke away for the hillside at the far end of the deer park, crossing acres of turf diversified and dotted with noble trees, which stand in couples, groups, belts, or quasi-avenues, with an effect that does great credit to those who dictated the thinning process. Scotch firs, spruces, elms, oaks, and chestnuts pose themselves by twos and threes, as if with a consciousness of their charm to the painter or the poet; and it is long since we have seen so many or such perfect studies of tree-form. Many and curious species of cortinarius were met with *en route* to the hill, from which there was a very fine and panoramic view of West and North Herefordshire, and the hills that bound it, to say nothing of the sleepy but quaint little town of Weobley, just beyond Garnstone. On the frequent charcoal heaps met with in ascending the hill were found *Ag. Carbonarius* with *Ag. Pyxidatus* and *Cantharellus radicosus;* and, when the ascent was made, Dr. Bull found *Ag.* (Entoloma) *jubatus*, a very rare fungus, first figured as a British plant in the Woolhope Transactions for 1868.

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It may be noticed generally, as the effect of a very dry season up to three or four weeks ago, that many tribes of funguses, such as the Boleti, were almost absent. Still *B. Laricinus*, only known within the last few years, was very abundant. *B. elegans* and *B. fragrans*, too, were beginning to appear. The very common *Ag. fasciculuris* was scarcely to be seen, though its intimate relation, *sublateritius*, was frequent enough. *Naucoria cucumis* was very common, as also, even more, was the curious *Hygrophorus cossus*. In many places visited during the week this was noticeable with its odd and goatlike smell, amongst others in an orchard at Stoke Edith, near the station, where a ring of it was found some eight feet in diameter. Then, again, the great scarcity of all the tree polypores was remarkable, so much so, as, with the other absences we have referred to, to demonstrate the unusual unproductiveness of the season, in a mycological point of view, arising out of the impossibility of mycelium growth taking place in such very dry weather.

Some such train of thought was passing through at least one mind, out of the thirteen or fourteen that visited Garnstone Park, when a summons to return to the mansion interrupted it. Here a handsome lunch-dinner had been provided, to which, after they had inspected some admirable photographs executed by Major Peploe, the mycologists did thorough justice. It need not be said that they left Garnstone, between five and six p.m., with thanks on their lips and good will in their hearts towards their courteous host, who had done everything in his power to make the remembrance of their visit a pleasant one. As the coach drove off in one direction towards Hereford, with a lighter freight, yet not with lightened cheer, the President and Mr. Worthington Smith took their way, in the carriage of the former, towards Moor Court, the best friends finding it a necessity to part sooner or later. This necessity was felt more widely on the morrow, when the Woolhopians and their guests mostly dispersed for their respective homes.

(Saturday Review.)

A Day with the Fungus Hunters.—Another fungus feast, and no casualties! Once more have the mycologists, indigenous and other, hunted and harried the woods, fir-grooves and pastures of Herefordshire in pursuit of game, which squires do not care to preserve, and to which farmers do not raise the faintest objection. Once more have they returned towards dusk to the "faithful city," bearing bags and baskets filled with spoil destined to give variety to more than one cuisine. So far as the adoption of the study of mycology, as a special feature of the Woolhope Field Club transactions, tended in six years to "Italianize" the tastes of diners-out in the matter of fungi, that we believe the excellence of a "Lycoperdon" fritter might be avouched by the highest ecclesiastical dignitaries; and, unless our eyes deceived us, the High Sheriff of the county of Hereford could certify the goodness of "Comatus" soup. It is not of course contended that among the results of the forays which made the woods of

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Downton, Stoke Edith, Dinmore, and Garnstone all alive in the first week of October there were not a number of diverse toadstools, wholly unfit for human food; but a residuum of edible fungi was tried, tested, and not found fault with by the guests at the public dinner on the first of the month, who; though disappointed of the presence of the Rev. M. J. Berkeley, the chief of English mycologists, included in their number those scarcely less eminent authorities, Messrs. Broome, Renny, and Houghton, to say nothing of that skilful delineator and describer of fungus-growths, Mr. Worthington Smith, F.L.S. The proceedings of the evening included a merited recognition of the assistance rendered to the Club by this gentleman, whose two sheets distinguishing edible from poisonous fungi, with the key appertaining to them (published by Hardwicke), are still the most useful guide to the amateur fungus-hunter, though for more advanced inquirers the manuals of Berkeley and Cook, and, for the more classically minded, the charming volume of Dr. Badham, are doubless more suitable. The delicately-served Marasmius oreades, or "Fairy Ring Champignon," enabled the veteran Mr. Lees to return for the hundredth time to his "molar" theory as to fairy rings; the orange-milked mushroom (Lactarius deliciosus) justified its title, after skilful cooking and a good deal of salting and peppering; and if on this occasion we failed to experiment upon the scaly agaric (Procerus), the beef-steak that is cut to order from half way up the oak (Festulina hepatica), or the Boletus edulis, (not that in favour with the elder Roman gourmands, though very popular with their remote posterity), or even the Giant Puffball (Lycoperdon giganteum), it is simply because, in the case of fungus-tasting as in everything else, "non omnia possumus omnes." The Lactarius deliciosus ought to be good, to judge from its name; and its beauty of colouring and deep orange milk so completely distinguish it from the dangerous L. torminosus, the deadly and ruddy L. rufus, the fragrant and rare L. glyciosmus, L, controversus (a species not uncommonly found under the black poplar, but on this occasion discovered by Dr. McCullough under a Lombardy poplar at Garnstone), and the L. Vitellinus, which, notwithstanding its epithet, is not good for food, that there need not be slightest hesitation in tasting it, even raw. Dr. Badham's plan of baking the Deliciosus, after due application of salt, pepper, and butter, for three-quarters of an hour in a covered pie-dish, is doubtless a preferable mode of experimenting upon this delicacy. Our own experience of it is not so fortunate as to enable us to rank it with the most appetizing of culinary fungi; nor can we mention it in the same day with slices of the Giant Puff ball, when, after the removal of their outer integument, they are dipped in yolk of egg, and then fried in fresh butter. In all such experiments it is obviously unfair to try other than quite fresh and young specimens, and there ought to be no necessity for cautioning even the uninitiated against cooking the Puff ball when it is yellow and rotten inside, or indeed when its snow-white exterior is beginning to change to a suspicious yellow. Several of the rarer Lactarii mentioned above were either found in this year's forays at Hereford, or were brought thither to adorn the sideboard at the festival.

A word must be added about the "Comatus" soup. What boy or girl

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accustomed to roam over field and pasture does not know the quaint, cylindrical "Tall John," with a fleshy and patchy white wig, and a hollow stem with a white powdery fragile ring encircling it, known to mycologists as the "Coprinus comatus," and sometimes as the "agaric of civilization;" but hardly less familiar to hundreds who cannot put a name to it, and who come across it and its gray-capped cousin C. Atramentarias, in the open garden or at the base of stumps or palings? This fungus has long been mixed with others in the composition of ketchup, and Atramentarius is said to make very good ink. It has been reserved for the Woolhope Club to demonstrate its value as the principal ingredient in a piquant and tasty soup, to outward appearance resembling green-pea soup, or perhaps more closely parsley and butter in a tureen. Whatever its semblance, it is too good an addition to our list of soups to be lightly forgotten; and perhaps the day will yet come when those philosophers whose mental grasp can embrace nothing higher than the addition of another and another novelty to their gastronomic pleasures may learn to count amongst their benefactors the motley group of mycologists whom an inscribed festoon in one of the streets at the recent opening of the Free Library at Hereford designates irreverently and illiterately as the "Fungi Fogies" After all, however, even putting the question of edibility aside, it is not difficult to find good reasons for prosecuting the study of mycology. Medicinally and industrially many fungi have their special purpose, as for instance the scaly Polyporus, which, dried and cut into stripes, supplies a capital razor strop, and the other species of the same group which are manufactured into and by the styptic known as Amadou or German Tinder. The medicinal substance known as ergot of rye is also, it need hardly be said, a true fungus. Generally, too, to quote the highest English authority on the subject, "the office of fungi in the organised word is to check exuberant growth, to facilitate decomposition, to regulate the balance of the component parts of the atmosphere, to promote fertility, and to nourish myriads of the smaller members of the animal kingdom." Regarded in this practical light, the numerous family of funguses asserts a strong title to intelligent study, and cannot lightly be overlooked by any Field Club that deserves its name. An attempt to catalogue the fungi which line the woodland path, or have their habitation at the foot or amid the branches of the oak, ash, elm, the larch and fir, the birch and the poplar, would very soon exhaust our paper.

Amidst the things of beauty—though certainly not of joy to the incautious taster—in fungus life may be cited the Boletus luridus, umber-coloured above, and bright red or even vermilion below, and suspiciously changing, when broken or bruised, to a blue complexion. Or, again, the *Fly Agaric* Agaricus (Amanita) *muscarius*, with its bright scarlet cap, worked, so to speak, with yellow or yellowish spots, and underlaid with a bright yellow flesh, which is succeeded, lower still, by a pervading white. Its stem is bulbous and marked by a distinctive ring. The Peziza aurantia is another perfectly lovely tenant of the woods and heaths, a delicate crisping "lamina" of the brighest orange, which no one will forget who saw the other day a specimen of it, measuring eight and a half inches

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across, sent from Shobdon Court by Lord Bateman. Amongst the Russulas, found freely this year as usual in Herefordshire, there is as great a variety of hue as of wholesomeness, from the pale pink and faint rose to the brilliant scarlet of R. emetica. Cortinarius cinnabarinus is a clustering group, of a bright orange or nearly vermilion, with a metallic lustre. The Cinnamon Mushroom (Cortinarius Cinnamoneus) appeals to the sense of smell as well as of seeing, and there are several fungi of which the recent expedition furnished specimens which make the former appeal without any pretence to the latter. Before glancing at these we must just name the violet-capped Agaricus euchrous, found at Dinmore Woods on the 30th of September; the Coprinus picaceus, or *Magpie* Coprinus, a rare roadside fungus met with near Downton, the membraned cap of which is variegated with broad white scales, whilst its gills are free and of an ashen black; the mouse-gray Agaricus gloiocephalus, of which a large group was exhibited by Dr. Chapman from off the pastures of Burghill; and the rare, pale yellow crisped Sparassis, which has been more than once imported into these shows from the fir-groves of Chetwynd by Mr. Houghton. We must also say a word on the odorous fungi, whether sweet savoured or the contrary. Of the first sort there were found at Stoke Edith, Lactarius glyciosmus, and Agaricus fragrans and odorus; of the second, at Dinmore, the Agaricus cucumis, in an abundance commensurate with its strong odour, suggestive of rancid oil or stinking fish. Ag. saponaceus, too, was offered to our scrutiny, but pronounced, after deliberation, to savour more of fish-oil than of soap; and the interest displayed in Dr. Chapman's fine group of Gloiocephalus was to a certain extent qualified by its exceedingly repulsive smell. Occasionally in the course of the forays one lighted on a family of fungi, such as Agaricus mucidus, the associations of which are more with the touch than the sight or smell. Unpleasantly slimy, it arrested the notice of the Woolhopians by its profusion at a certain point in Stoke Edith woods, both on the ground roots and on the tall, fine-grown beeches, which are its home. The mention of these silvan beauties suggests another element of interest in fungus-hunting—namely, the introduction it gives one to the finest timber in our land. As we have said, the fungi love the greenwood. And if, in the recent excursions around Hereford, the curious in such matters were too late by a couple of centuries to see at Stoke Edith the Elizabethan house of many gables, long since superseded by the present stately quadrangular mansion, or at Garnstone the original and characteristic mansion as appeared in 1675, and was represented in Dingley's sketch, known to readers of the Camden Society's publications, in the place of which is a castellated mansion built by Nash, yet in each case they might have made acquaintance with giant oaks and stately elms which perchance have been the silent witnesses of changes yet earlier than these; oaks and elms still betraying no traces of decrepitude, and still, as of old, giving grace, dignity, and picturesqueness to the landscape. It is not every day that one sees anything so perfect in its way as the great hall at Stoke Edith, the walls and ceilings of which were painted by Sir James Thornhill, or as the geometric flower garden designed by Nesfield; and yet an explorer might be still better employed in threading the paths of the richly-timbered deer-park and making his way to the broad and lofty ridge of Seagar

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Hill, whence he may look out upon the country towards Gloucester, Monmouth, Abergavenny, Bromyard, and Salop, to say nothing of the hill and valley of Woolhope nestling close beneath his] standpoint. And so with the demesne of Garnstone; the predominant charm is in the deer-park, and the heights that bound it, the latter commanding exquisite views of North and East Herefordshire, as well as of Shropshire and the mountain barriers of Radnorshire, the former affording a study of single trees and clumps and groups of extreme beauty, such as is not often to be met with. Here a couple of Scotch firs, there a noble spruce or silver fir, arrest the eye by their perfectness of symmetry or their rich contrast of form and colouring with their surroundings. Groups of Spanish Chestnuts, clumps of elms, or avenue-like arrangements of the same, promising Wellingtonias, and the like, show how much good taste may achieve, without the aid of a professional landscape-gardener, where the proprietor finds himself possessed of an over-abundance of fine timber, and approaches the task of thinning as a labour of love. Within the lawn and sunk fence at Garnstone, the mycologists were are as much struck with the thriving conifers of comparatively recent introduction as with the special denizens of the turf in quest of which they had come. There were perfect samples, for their ages, of the Piceas, Nobilis, Cephalonica, and Pinsapo, as well as of the Californian P. bracteata, the leafy-bracted silver fir, a very promising young tree, which, perhaps on account of a well-chosen aspect, shows here no tendency to premature starting into growth, and thus is less affected by late spring frosts. The complaint of this species generally is the tenderness of its younger growths.

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ON THE OCCASIONAL APPEARANCE OF RARE FUNGI, AND THEIR NON-PERSISTENCE,

BY EDWIN LEES, F.L.S., F.G.S.,

President of the Malvern Naturalists' Field Club.

Linnæus, who had the happy art of arranging the forms both of animal and vegetable life in a systematic as well as an agreeable way, so as to attract the fancy as well as assist the memory, gave the name of Nomades, or Wanderers, to the tribe of Fungi, from the observed fact that their various families and species are like gipsies, for ever wandering about from one region to another, and seldom or ever certainly be found in succeeding years at the same place.

This is generally true with respect to the Agarics and Boleti, as well as the members of several other genera, that appear and disappear so irregularly as to baffle any theory that may attempt to account for it. Indeed, like comets that suddenly appear in our system never to present themselves to our view again, so, many funguses may be noticed one year in a particular spot, and though diligent search may be made, they will never be found in that locality again.

But with all funguses the idea of perpetual wandering about will not hold good, as the Polypores, for instance, when once attached to a tree remain there for life, or until the tree becomes a total wreck. A willow may often be seen loaded with *Polyporus igniarius*, which preys upon its juices; and the ash in like manner is often annoyed with a still weightier load in *Polyporus fraxineus*, or studded with the black charcoal-like balls of *Hypoxylon concentricum*. All decaying wood, too, invites the insidious fungoid parasites, that like vultures delight in carrion, though in their case of a vegetable nature, but they do not fly off like vultures, but remain while there is any nutriment left for them to subsist upon. Thus a fallan trunk in autumn will be seen covered with the black glue-like *Bulgaria inquinans*, or old decaying elder-trees are hung with the curious-shaped "Jews' Ears" *Herneola Auricula Judæ)*, while the *Polyporus versicolor* is common enough on stumps in woods, and is as permanent as the stumps themselves. Other examples may be given in the "Roast-beef" Fungus *(Fistulina hepatica)*, the corky *Xylaria hypoxylon*, and the *Dedalæa quircina*, not to mention the minuter families of *Sphæriaceæ* attached to old wood and other substances.

But some of the Agarics, also, encamp upon the ground for a considerable time, especially those that establish themselves within the circumferential limits of a fairy ring. And here I must remark, that though several species of Agarics take possession of a ring, they do not themselves form it in the first instance. This, no doubt, the members of the Woolhope Club are well aware of from my former observations on fairy rings, and my paper printed in their transactions,

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and I need not now enlarge upon the subject. Yet it is astonishing how few mycologists fully understand the matter from want of attentive observation. Only a few weeks since a learned physician, at a meeting of the Royal Horticultural Society, made some remarks upon the nitrogenous nature of "the Agarics that formed fairy rings." It is cerainly a mistake to suppose that rings of considerable size, appearing suddenly, as they often do—which is the only pretence for the ancient legend of fairies dancing—could be formed in a single night from the deposition of sporules from a single central agaric, besides which, entirely perfect circles are rarely to be met with, the so-called rings being mostly arcs or irregular waving lines. But whatever the *modus operandi*, whenever Agarics have colonized the exterior line of a fairy ring, they remain there as long as they can, and by their spreading mycelia enlarge it. This is particularly the case with *Marasmius Oreades*, and in a lesser degree with *Tricholoma gambosus;* but the other inhabitants of rings are more or less fugitive. A crowd of *Tricholoma gramnopodius* or *Clitocybe geotrupus* may appear in a ring one year, and the next the ring will be entirely unoccupied, and not a single agaric be seen there. The *Marasmius Oreades*, indeed, often lingers for years, forming a colony and making a wide brown space, not always, as is generally supposed, keeping to a circular form; but as individual life, both animal and vegetable, must have a termination, so at last even the *Oreades* finds sufficient nutriment wanting and dies out. But though the mycelium of ring agarics, whether the *Marasmius* or others, certainly dies out after a time, what, it may be asked, becomes of the spores? These must be very numerous, and one might think, would suffice to cover the field; but they fail to do so, and, like winged seeds, they must fly off somewhere—no doubt to colonise other rings.

I have at the present time no general theory to propose on the duration or spread of agaric life, for the remarks that I now make are only to be considered as pegs on which to hang the sketches of some curious or remarkable funguses that I have found at different times, and which have only once or twice come under my notice. Possibly more diligent or persevering fungus-hunters may have gathered them oftener in searching divers places, but, of course, I can only refer to my own experience; and it certainly is a matter for wonder that a single fungus, or perhaps a group of a remarkable species, should appear to view at a particular spot and never be met with at that place again. This must be within the experience of all practical mycologists, and I can only suppose that a peculiar nutriment that gave growth to the fungus was exhausted, and the spores of the fungus once observed flew off to find that nutriment elsewhere. Where fungi appear upon the dung of animals I think it may be well presumed that in some way or other the sphores of such fungi must have been taken into the stomachs of the animals, and after deposition on the ground have soon after vegetated, the impulse being given them accordingly. I once gathered a moderate-sized yellow *Peziza* on some sheep's droppings in a cave on the Malvern Hills, and I afterward found on the same species of *Peziza* upon sheep's dung in Switzerland, but I never found it again on the Malvern Hills. A question may thus arise

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whether, under similar conditions, the same fungus may not appear in widely separated countries.

Funguses, as well as other plants, require nutriment for their support, and a strong nutriment, too, that enlarges their cellular structure, and induces that impulsive sudden growth that fills the woods with Agarics and other fungi at the autumnal season in so short a time. The impulse is almost as sudden as the discharge of a gun, but exhaustion very soon follows, and some Agarics are so fragile after their expansion that a breath withers them, and others dissolve into liquidity very soon after gathering. The impulsive force that elevates an agaric or boletus must be very great, for instances have been known of their lifting considerable weights. Only a fortnight since the flag pavement in front of a tradesman's residence in the High-street, Worcester, was lifted up and this so near his celler grating, that he believed that burglars had made an attempt upon his premises, and the police were sent for to investigate the matter. On the flag-stone being entirely removed, three huge mushrooms were found beneath it, having very thick compressed stalks, and these, in their efforts to see the light of day, had considerably uplifted a flag-stone of more than 80 pounds weight. The incident was inserted in the *Worcester Herald*, with the heading, "Attempted Burglary by Mushrooms."

That certain funguses do suddenly appear—perhaps from peculiar meteorological conditions—and then disappear altogether from the locality they were noticed in, is certain; but I must admit also, that imperfect observation may in some instances account for apparent anomalies—not, however in all. Dr. Withering, late in the last century, detected and described the Agarics and Boleti that grew in Edgbaston Park, near Birmingham, and several of these have never appeared again, though the park has been searched by myself and other observant botanists. Mr. Stackhouse, a correspondent of Dr. Withering, also mentions some rare Agarics that he gathered in Caplar Wood, near Hereford, which we have since searched for in vain. Mr. Berkeley in his "Outlines of Fungology," mentions several species figured and described by Bolton in his "Fungi of Halifax," and by Sowerby, in his "English Fungi," which have never been again observed in this country. Indeed, it must be within the experience of every practical fungologist, that unless he gathers an uncommon fungus at the time he notices it, he will not find it again at the same spot another year. So that there is no certainty that localities put down for rare Agarics or Boleti, as well as other funguses, will reproduce them in successive years. I have been often disappointed in searching for rings of *Tricholoma gambosus* and *Clitocybe geotropus* where they were evident to view the year before. and so with many other of the rarer species of fungi. I have, however been in the habit for many years past of sketching all funguses that came under my observation, and some of those that I have only been able to find once or twice through a lapse of years, may excite your curiosity and deserve attention for their rarity.

[Mr. Lees then exhibited many careful drawings illustrative of his remarks, which included *Agaricus flabelliformis*, *Marasmius alliaceus*, *Nyctalis parasitica*,

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Coprinus picaceus, Polyporus giganteus and *P. frondosus, Strobilomyces strobilaceus, Hydnum graveolens, Lentinus tigrinus, Morchella semi-libera, Helvella Ardenia and elastica, Mitrula paludosa, Tulostoma mammosum,* several *Geasters, Piziza reticulata,* and *atro-rufa,* and several others- With regard to the very local *Cantharellus cinereus,* of which Mr. Berkeley had stated that it had not been met with since the time of Bolton in the last century, Mr. Lees observed that ten years ago he found it in some abundance in Perry Wood, near Worcester, and the same year received it from Dr. Bull, who had gathered it near Hereford, but strange to say neither of them had met with that *Cantharellus* since.]

Of course the spores of Fungi are taken up into the air, and are carried anywhere and everywhere. Accidentally broken and trodden upon, we see how the spores of a puff-ball rise like smoke into the atmosphere, soon lost to sight, and the spores of other species thus carried upward descend to the ground with rain. A little room of mine at home is unfortunately by a crack in the ceiling open to admit rain when it is continuous. Last autumn a quantity of rain rain down one side of the room, which is now blackwashed with the spores of *Coprini,* and a group of the *Coprinus cinereus* appeared upon the ceiling. So the *Merulius lachrymans* gets into neglected rooms, and as I myself saw, intruded among the shelves of the cathedral library at Worcester, and even sported itself among the bindings of books—perhaps not very often opened. No wonder, then, wherever damp or moisture exists, there fungi will penetrate in the shape of mould or mildew, covering the exterior of our jams and jellies, deforming the plants in our gardens and conservatories, eating up our potatoes, getting into our herbaria, and rendering our gathered fruits rotten. Air, earth, and water are all infested with fungi, and thus they claim admittance in every direction. I was once rambling with my late excellent friend Dr. G. Griffiths, then resident in Worcester, among the defiles of the Malvern Hills, when we were overtaken by a thunderstrom, during which a quantity of hail fell. I collected some of the hailstones on the spot, and placed them in a bottle, where they dissolved into a discoloured fluid, which, when placed under the microscope as soon as I got home, proved to be full of the spores of fungi of which I made a sketch. Thus, then, spores must fall abundantly with rain, or be dispersed by the winds in various directions.

I must beg you to consider my remarks as only intended for familiar illustrations, for I shall not enter on the microscopical organs of the fungi, or advance any theory of my own or other scientific mycologists as to their mode of fructification or commencement of growth. We must, however, consider them as meteoric plants, whose appearance depends upon temperature and conditions of the atmosphere, and with the exception of the hard, persistent species attached to ligneous or manufactured substances, equally impatient of extreme heat or the frosts of winter.

In a lower tribe of vegetation like this extensive mycological world, one might expect, if anywhere, to mark traces, if not actual examples, of those changes of form that Darwin has so descanted upon, and which has met with so many advocates. We do, indeed, find the common mould *(Aspergillus glaucus)*

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take diversified shapes, and the myceloid state of *Penicillium crustaceum*, commonly called "the vinegar plant," would not be known correctly without study and observation; while many minor mycological forms, at first properly considered as distinct species, have been observed to be only states of one, analagous to the caterpillar advancing to the winged butterfly. Thus the *Æcidium* of the barberry has been asserted to be really a form of the mildew *(Puccinia graminis)*, that attacks growing corn; and if this is proved to be truly the case, the farmers were right in believing the vicinity of the barberry detrimental to their wheat fields, and in rooting it up whenever they perceived it, as they have done in Worcestershire. The *Isariæ* and some other small fungoid substances described as species have also by systematic writers heen adjudged not to be autonymous. On these somewhat abstruse points I must refer you to Mr. Berkeley and other technical writers, British and foreign, who have treated on the subject in full detail. But though some forms of Agarics do apparently approach each other in a very puzzling manner I do not believe in changes or advances from one genus to another, for even the two ordinary kinds of mushrooms *(Psaliota campestris* and *arvensis)* are easily distinguised by common people, and inviting as theory is to some minds, I am contented to see objects as they now appear, and do not believe that an Agaric can be induced to become a Polypore or *vice versa*. Still hypotheses may be useful as eliciting research, and it is an excellent maxim to "prove all things and hold fast that which is good."

But though we may differ as to theory, and there is some difficulty as to the classification and nomenclature of the different genera and sub-genera of fungi, to say nothing of species, we shall all agree with Dr. Badham that fungus-hunting gives as much pleasurable excitement as any other hunting sport, and that it may be recommended to the naturalist not only for the beauty of the objects that are sure to be found, but it brings the wanderer out of beaten paths into striking scenes and romantic bowery spots of sylvan solitude that he would not otherwise have explored, and at the present period of the year, when the woods are arrayed in colorific glory, Woolhopeians have with joyous enthusiasm urged their Fungus Forays year after year, and I may therefore here fitly use the exciting language of Charles Mackay with a trifling alteration :—

"Men of thought! be up and stirring night and day,
There's a fount about to stream,
There's a light about to beam,
There's a warmth about to glow;
Funguses can joys bestow,
More than common minds can know!
Men of thought and men of action,
Here can find full satisfaction;"

especially if they eat the funguses they find by Dr. Bull's exquisite recipes. Shakespeare has said—

"All things that are,
Are with more spirit chas-ed than enjoyed;"

and to some persons there is more pleasure in the search for an object than in the attainment of it, but the fungologist cannot agree with this, for we search with the determination to find—and how exciting it is to the naturalist to find something new—and our Fungus Forays are so productive both of delight in the search

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and the instruction that is gained from what is gathered that I trust this peculiar feature of the Woolhope Club will always be maintained as long as Autumn calls forth the favourite tribe that urges our pleasurable investigations (applause).

Mr. ELMES Y. STEELE expressed the pleasure he had felt in seeing their old friend Mr. Lees present, and hearing his very interesting paper. For his own part, he did not quite concur with their friend in his theory as to the disappearance of species of fungus and dispersion of the fungus spores, and he hoped that, in justice to their friend, it would be fully discussed that evening. He was glad to see that Mr. Flavell Edmunds was present, because they had very interesting discussions at former meetings between him and Mr. Lees, on the subject of the formation of fairy rings, and other interesting questions. He remembered in particular the discussion between them on the seeds of flowering plants, and the question whether the sudden appearance of plants in certain cases was to be attributed to these seeds having been brought to the surface after having being long buried, or to their having been transported by the wind. He was quite sure Mr. Lees would not feel satisfied if his paper were allowed to pass without discussion, and so he had spoken by way of setting the ball rolling.

Mr. PHILLIPS being called upon by the President, said he hoped it may not be thought presumptuous in him to differ from his esteemed friend, Mr. Lees, on some of the views that had been advanced relative to the non-appearance of certain species of fungi found by himself and by some of the old authors. He thought his friend had exaggerated ideas with regard to this subject, and especially to the dying out of the spores. It must be borne in mind that fungi require very peculiar conditions of atmosphere for their growth, and the mycelium may be dormant or unproductive of the perfect plant till the fortunate moment when all the conditions are present. This may be illustrated by apple crops, for which this county is so distinguished throughout England. We all know that some years there are lacking such conditions as are required to produce a crop, but the trees are still there though the fruit is not present. So it is with fungi: the mycelium is in the old habitat, but conditions are not favourable to its full development. Then again, the existence of the mature plant is often so brief that unless the searcher happens to select the exact time in the year when all these necessary conditions alluded to conspire to produce the fungus he seeks, it is evident he may search in vain. Mr. Lees has instanced the case where some of the older English authors, as Bolton, Sowerby, and others, have described species of fungi which have never since been met with. One of the causes to account for this is that some of the earlier writers gave very imperfect descriptions, so imperfect as to render their identification with recently found species all but impossible, besides which they often described or figured mere monstrosities. The figures passed round the room this evening, executed by Mr. Lees himself, though very characteristic and faithful, comprised one that would puzzle an experienced fungologist to say what it was only for a very small specimen of the typical form that accompanied it, of the Large-clubbed Clavaria (*Clavaria pistillaris*) which he says he has never met with since. He has evidently figured an abnormal form of this somewhat common Clavaria, and when those figures are published to the world some

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future advocate of this theory may quote this figure as a confirmation of his views. We may go year after year to particular old tree stumps and find the same species flourishing on it; certain pastures in our own neighbourhood are well known for the production of mushrooms in every favourable year and even the rare cone-like Boletus *(Strobilomyces strobilaceus)*, which he says never occurs two years in succession, he (the speaker) found last year after the Woolhope meeting, in the same spot, near Ludlow, in which he found it in the year preceding, and he had very little doubt it would be found again this year. On the whole, however, he agreed with his friend, and desired to give him his personal thanks for his interesting paper (applause).

Dr. BULL briefly expressed the pleasure he had felt in hearing Mr. Lees' paper. He doubted, however, whether their friend was quite correct in supposing that the members of the club were converted to his views, even in the modified form in which they had been expressed. He observed that Mr. Lees had given up the molar theory of the formation of fairy rings. The disappearance and re-appearance of particular species was another point on which he did not quite agree with their friend. He remembered a case in which the uprooting of a tree, and the consequent disturbance of the soil, was followed by the appearance of a fungus perfectly new to Britian, and which was hailed by Mr. Berkeley and other eminent mycologists as a treasure (applause).

Mr. FLAVELL EDMUNDS, having been called upon by the President, rose and was received with applause. He said that he had been greatly interested with the paper of his old friend, which like all his other writings was full of curious facts valuable in themselves, and explained with great clearness. As their friend Mr. Steele had said, it was well worthy of the attention of all who heard it, and of the careful discussion which was invited. Mr. Steele's reminiscence of former encounters between himself and Mr. Lees went back nearly 20 years, but his own reminiscences went back much further. Mr. Lees and he were friends of nearly thirty years' standing: and he remembered hearing his friend deliver in the year 1845 some most admirable lectures on the Comicalities of Trees, in which he took up the grotesque forms assumed by trees, and by the aid of his ever facile pencil and his bright and cheery humour made what would otherwise have been a dry subject full of life, instruction, and amusement. He was glad to find all these characteristics still as vigorous as ever in their friend, as his paper and his sketches that evening abundantly proved (applause). He felt almost inclined to fling at him a well worn Latin quotation, but that he had a bit of a quarrel with the first and the last words of it. The Roman poet had said *Forsan hæc olim meminisse juvabit;* but whether he thought of his friend's past contributions to natural history, or meetings like the present which he had helped to make pleasant, he disputed both the *forsan* and the future tense of the verb. There is no *perhaps* in the matter: it actually does now delight us to remember these things (applause). At the same time he must not be supposed as concurring in the supposition that the members of the Woolhope Club had been generally converted to Mr. Lees' theory of the formation of fairy rings, either in its former or its present form,

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He did not know of any one who accepted what had been wittily called the molecular theory, and he doubted whether any of the members were convinced of the correctness of the explanation given to them that evening. For his own part, he still held to the belief that fairy rings were formed by the spreading outward of the mycelium of the fungi from a centre. Within the last few days he had seen a very remarkable instance of the correctness of this theory in the park of Lord Saye and Sele, at Broughton Castle, Oxfordshire. He handed to Mr. Lees a rude pencil sketch of this fairy ring, which was of large size, and was evidently in the process of enlargement. It is made up of a great number of concentric rings, the course of which is marked here and there by single fungi, the last survivors in the ancient seats of their race; but the rings are being gradually obliterated towards the centre by the growth of darker grass. There is a considerable growth of fungi of the outer edge of the ring, which is complete with the exception of a space of about a foot at the west side. The fungi were all of one species. He mentioned this, because it was the latest fact of the kind which he had met with, but in former years he had met with many similar cases in the neighbourhood of Hereford, at Canon Moor, Burcott, Lyde, &c., in none of which were there any traces of the mole's action. Then, too, as to the disappearance of fungi. He knew of cases in which *Agaricus comatus* and *A. procerus* had come up regularly near the same spot for years past, and he could always calculate safely on finding various species of Lycoperdon, Clavaria, and other genera of fungi in particular places. No doubt there are instances of the disappearance of plants, fungi as well as flowering plants, but he did not think that they could be traced to any one cause or set of causes (applause).

The discussion here closed, the remaining papers being reserved to be read at the soiree, to which the President and members were invited by Mr. Cam.

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NOTES ON THE STRUCTURE OF THREE SPECIES OF FUNGI NEW TO BRITAIN,

BY WILLIAM PHILLIPS.

That the study of Mycology is making rapid progress in the estimation of English botanists is proved by the fact that no less than three public exhibitions of fungi will have taken place during the present year, one in the city of Aberdeen a fortnight since, another in connexion with the Royal Horticultural Society in London, and the present one in this room, under the auspices of the Woolhope Field Club. I believe I am correct when I say that the credit of originating such exhibitions belongs exclusively to your excellent Club, and more especially to the fertile brain of one of its chief ornaments. Up to a comparatively recent date this branch of botany was confined to the attention of a very limited number of students, while it was altogether ignored by what we are accustomed to designate "an enlightened public." This was attributable mainly to the fact that our literature, unlike that of France and Germany, contained few works adapted to smooth the way of a beginner, in this confessedly difficult study, at a price within the reach of ordinary persons. No sooner were such works published than the number of students became greatly augmented, and as a necessary consequence our Mycological flora became rapidly enriched. In 1836 the fifth volume of "Smith's English Flora" appeared, containing the first, anything like complete, list of British species from the pen of that distinguished botanist, the Rev. M. J. Berkeley. This book brought together the information scattered through the works of Withering, Bolton, Sowerby, Grevelle, Purton, and other English botanists, enumerating and describing 1279 species. The beautiful drawings of Sowerby and Grevelle had thrown a charm over the study of Mycology and exalted it to a position of eminence it had not previously attained. English botanists became enamoured of the study, and they in turn infected a wide circle of followers, to whom the appearance of Mr. Berkeley's work was a great boon. The attention of others than professed botanists was thus attracted to this hitherto neglected world of vegetation, and men began to see that it comprised forms of surpassing beauty, colours the most brilliant and varied, structure the most complex and interesting. About this time the microscope became a more perfect instrument, so that bodies, which like "nebulæ" to the early astronomers, were perplexing enigmas, were seen to be well defined organs having each its special function, while some of the subtle processes of reproduction and growth could be carefully observed. M. Corda, a distinguished German Mycologist, in his splendid "Prachtflora," figures the strange and often fantastic, but always beautiful forms,

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assumed by the *mucidinæ*, and was himself so enraptured with them that he writes :—"These forms are so different from all other plants of a superior order that they appear to me as a benefaction from the Almighty to compensate the naturalist for the pain of being placed on the arid soil of Europe, deprived of the rich vegetation of the tropics." The fascination these studies exercised over the mind of this celebrated German was shared in by many of our own countrymen, one of the results of which was the addition, during the 22 years between the publication of "English Flora" and Berkeley's "Outlines of Fungology" in 1860, of no less than 1101 species to the British list. Eleven years later Cooke's "Hand-book of British Fungi" came from the press, which gave an addition of 249 species, making a total of 2809 species.

I need not say that the mere addition of new species to the British list is not the highest aim of a Mycologist, but you will concur with me when I say that every addition is of interest in a country of limited area such as ours; it has occurred to me therefore that a brief description, accompanied with drawings,* of three species new to this country may not be unacceptable on this occasion.

Peziza brunneola, Desm, is a minute species found growing on decaying leaves of the Oak and Spanish Chestnut not more than $\frac{3}{100}$ of an inch high, and very similar in colour to the leaf on which it is found. The cup is supported on a short stem, giving the appearance of a microscopic acorn cup from which the acorn has fallen. It is coated outside with brown hairs, which towards the margin form a fringe. These hairs under the microscope appear to be hollow, divided within at certain intervals by partitions or septa: the summit is enlarged into a kind of knob on which is seated a mass of minute granules, the exact function of which has never been determined. Within the cup is the *hymenium*, consisting of a dense bed of *asci* and *paraphyses*. The peculiarity to which I wish specially to call your attention is the shape of these paraphyses, a character much more common than is generally supposed in the section *Dasyscyphæ* to which it belongs, and first observe, if I mistake not, by M. Desmaziére. These paraphyses, unlike those usually found in *Discomycetes* are nearly as broad as the asci, and twice the length, tapering upwards into a spear-like point, so that if the hymenium be viewed by a tolerably high magnifying power it is seen to be villose from these projecting paraphyses. This may hereafter form an excellent character for the grouping of these minute species.

Desmazierella acicola, Libt. is a Peziza-like plant found growing on the dead leaves of Scotch Pine *(Pinus sylvestris)*. It was first described by a French lady, adame Libert, in the "Annales des Sciences Naturelles," 1829, accompanied by an excellent figure. Finding it differ from every other known species of Peziza, she created a new genus for it, named after her celebrated countryman, M. Desmaziére. This plant first appears on the pine leaves as a small ball of black entangled hairs, not larger than a pin's head, lying close to the surface of the leaf. After a time it opens at the top and gradually expands into a saucer-like form,

* The drawings appeared in "Grevillea," vol. iii., pl. 42.

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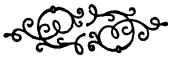
about two lines across, presenting a dark olive-brown disc, or hymenium. The outer margin is furnished with long, rigid, black hairs, while below this fringe on the outer surface there is a coating of entangled, flexuous black hairs. If a small portion of the hymenial surface be placed under the microscope it will be seen to consist of asci, each containing eight rather small sporidia. Intermixed with these asci there will be seen a number of straight, pointed, brownish-black hairs, much longer than the asci, and giving the hymenium the appearance of being hairy. These hairs I regard as the paraphyses, notwithstanding the character given by Madame Libert "without paraphyses," for if their structure be attentively observed it will be seen that they consist of a number of paraphyses united into bundles, branching off into bristle-like points, in the portion that rises above the asci, while the cells of this portion become carbonised. It is this peculiar form of paraphyses which justifies Madame Libert in placing the species in a new genus.

Pericornia Phillipsii, B. and Leight, is the third species to which I would call your attention, but respecting which I have little to say. It was found by me growing on naked earth, in North Wales, in May last. A *Thelocarpon*, (Lichen) was growing in company with it. This fungus is so small that it is nearly undistinguishable to the naked eye, and belongs to the section *Dermatiei*, a very interesting order of plants, though very simple in structure. It consists of a short stem composed of elongated, parallel cells, aglutinated together, which separate and spread out at the top into a sphærical head, which bears a vast number of echinulate sphærical spores—these are the organs of re-production. The life history of this plant, like the majority of fungi, is involved in obscurity, and awaits the patient and painstaking observation of the Mycological student, to bring it into the light. Let us hope that some member of this Club will direct his attention to these imperfectly understood growths, and confer a benefit on science by giving us their entire life-history.



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Woolhope Naturalists' Field Club.

ANNUAL MEETING,

MONDAY, APRIL 12TH, 1875.

The Annual Meeting of the Woolhope Naturalists' Field Club was held at the Club Room, Free Library, on Monday last. The following gentlemen were present:—Rev. James Davies, President; Rev. C. J. Robinson, President-elect; Rev. W. Jones Thomas, R. M. Lingwood, Esq., Rev. H. C. Key, Rev. H. W. Phillott, Dr. Bull, James Rankin, Esq., The Mayor, Dr. McCullough, Rev. H. T. Hill, E. W. Colt Williams, Esq., Frederick Bodenham, Esq., Rev. R. H. Williams, Rev. H. B. D. Marshall, Rev. J. E. Jones Machen, Timothy Curley, Esq., C.E.; J. Lloyd, Esq., Theo. Lane, Esq., Dr. Chapman, W. A. Swinburne, Esq., Jas. Davies, Esq., Joseph Greaves, Esq., H. C. Moore, Esq., T. Clifton Paris, Esq., Rev. J. H. Jukes, Rev. J. F. Crouch, Rev. Thomas Phillipps, Rev. James E. Grassett, J. E. Smith, Esq., Mr. Arthur Thompson, Treasurer and Assistant Serretary.

Mr. Curley was requested to act as auditor of the accounts, which were laid before the Club by the Secretary, Mr. Arthur Thompson.

It was proposed by the Rev. C. J. Robinson, seconded by Rev. H. T. Hill, and carried unanimously, that a sum of money be devoted annually to the purchase of scientific books for the use of the Club; and it was further proposed by the Mayor, and seconded by the Rev. W. Jones Thomas, and carried unanimously, that the Editorial Committee and Committee of Management be combined for the purpose of determining what books or periodicals be purchased in the present year, and to expend thereon a sum not exceeding £30.

It was decided that in future the cost of taking the register of the height of the River Wye be defrayed by the Club, and that the prize scheme be amended so far as to exclude the collection of eggs.

The Rev. W. E. Prickard, Vicar of Clyro, was elected a member, and the following gentlemen were proposed for membership: Rev. W. Wyatt, Vicar of Hope-under-Dinmore; John Riley, Esq., Putley Court; Rev. A. Young, Pembridge; Charles Anthony, jun., Esq., and Lewis Sergeant, Esq., Hereford; Rev. G. M. Metcalfe, Lyde Vicarage.

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The meetings of the Club for the present year were fixed as follows :—20th May, Caerleon ; 15th June, Symonds' Yat and Monmouth (to meet the Cotswold Club) ; 13th July (ladies' day), Skenfrith, Grosmont, and Garway ; 9th August, Brecon.

An exhibition of apples and pears (named) will be held in the autumn on the day of the Fungus Foray in the Club Room, and members are invited to send specimens of rare and fine sorts.

An interesting paper upon British spiders, their habits, economical use, &c., was read by Mr. Theophilus Lane.

After the meeting had concluded, the Club dined at the Green Dragon Hotel, where they were joined by Evan Pateshall, Esq., M.P., J. F. Symonds, Esq., the Rev. G. M. Metcalfe, &c. The cloth having been raised, the Rev. J. Davies, M.A., read his Retiring Address, which was as follows :—

Gentlemen,—The time has arrived when I must really make my bow, and positively for the last time. When, a year ago, I went through the form of a retiring address, it was in the full consciousness that mine was only a partial eclipse, and that I was to shine out again, a full blown president, at the first field meeting of the year 1874. Very pleasant, to me at least, has been the whole tenour of my second year of office, and marked indeed by two events, which I rejoice fell within the term of my presidency ; but I do not think it wise or desirable that this institution should follow, in the case of its chief officer, a precedent set it by the Municipality of Hereford ; and, however much I may have got used to your kind words, and kind faces, and warm shakes of Mr. President's hand, when on duty or off duty, I feel that, in view of sub-division of labour and circulation of honours, it is high time that I should hand over the reins to my successor. Before doing so, however, I must comply with the custom of giving some account of my stewardship ; and in doing this, it will be most convenient, I think, to review, as shortly as may be, the field meetings of the year, and then to touch, as they suggest themselves, on the points of progress, the collateral events, and the various casualties of the year 1874, in which the Woolhope Club has had more or lesss interest.

You will forgive me, I am sure, if, amid a press of matter, I omit aught that should be commemorated ; and, of your kindness, hear me patiently through an address which I promise to confine to moderate limits. Our first meeting a-field, I would remind you, was at Church Stretton on the 15th of May, and a rendezvous which proved very satisfactory when, in the year of Mr. Key's presidency, we explored the Longmynd, proved still attractive to those Woolhopians who re-visited it on a scarcely seasonable morning—for winter lingering still chilled the lap of May—*en route* for the Caradoc. We were fortunate, in the absence of any leader among our own members, in the friendly and experienced guidance of the Revs. Donald Carr and William Elliott, the late and the present honorary secretaries of the Caradoc Field Club, and thus lost no time in ascending the grand "Caer Caradoc" by the path through the pass betwixt it and the Lawley Hill. Despite the backwardness of the spring, our botanists found some small clients

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that had not succumbed to the biting frosts, and though the dog violet and even the bilberry were stunted, and the cowslips of the pass frost-bitten, the mountain pansy *(viola lutea)* with its bright yellow enlivened the hill-turf, and supplied an extempore bouquet for button-holes not strictly botanical. The chief interest of the day, however, was divided between the archæologists and the botanists. The former climbed a height of no small stiffness to inspect and interview a claimant to the honours of Caractacus's last battle, but this craze, so catching among us borderers who have any sort of British earthwork within a few miles of us, was kept under due control on this particular May morning.

It may be at once stated that Caer Caradoc, near Church Stretton, is a rude specimen of a British entrenchment, for the most part natural, but with so much of human handiwork as consisted in trenching across the ridge, below the peak connecting the crags, and the precipitous sides of the hill, and making a hollow on the other side of the peak. Neither in defensibility nor in natural water supply, were there the requisites for a strongly tenable position, and as to the faintest identity with the heights depicted by Tacitus—the *amnis vado incesto*, the *juga imminentia* and the heights above for the Britons to flee to—well! the Breidden near Welshpool have no rival in Caer Caradoc! Our geologists—a mere knot on this occasion—were content to refresh their interest in their favourite pursuit by a general survey rather than by special fossil-hunting. Whilst the visitor unattached peered through the haze at the Wrekin and Stiperstones, and had to content himself with the clear home view beneath him and immediately around him, the "stone-breakers" realised Mr. Symond's description of the "tremendous fault" looking westward from Caradoc, and "the proofs that considerable earthquake movements have affected the whole country since the deposition of the Upper Silurians."

Declining to investigate a limestone quarry—offering abundant specimens of Pentamerus Knightii—they descended the sheer hill-side to the north-west, crossed over the valley, and, with the exception of a detachment bent on re-visiting the slopes of the Longmynd, made their way back to Church Stretton. Here, while dinner was preparing, Mr. Wilson, the Rector, conducted them over his interesting church, and as for the dinner—I know not how it was—it sped so pleasantly that intending readers of papers had no other course than to pocket them, when, *dictum factum*, the President had almost in one breath to say grace after meal, propose the Queen's health, and give the word for the station. By favour of the belated railway train, indeed, we were able to convert the platform into an open-air chamber of science, and here, in the space of 20 minutes, the late Mr. Flavell Edmunds (upon whose presence with us at all our meetings a-field in the last year of his laborious and scantily recreated life I look back with peculiar pleasure), discoursed to us on the effects upon vegetation of the abnormal May frosts; and I myself found time to exhibit and tell the tale of a bit of Deerfold pottery, which proves the former civilisation of that terra *semi-cognita*.

It was a far finer day when, on the 19th of June, the Club set forth for Builth. Radnorshire never fails to prove attractive to Woolhopians, and I trust

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our peaceful forays on her side of the border leave a pleasanter and more civilising mark behind them than those raids of old across rock, river, and dyke, which kept up everlasting feud between the Celt and the Saxon. Our first point to make was Llechryd Station, where our brother Woolhopian, the Rev. W. John Thomas, a native of the district, and a brother of the Squire of Wellfield, which was to form part of the day's excursion, kindly undertook our guidance. Hard by the junction of the Mid Wales and the Central Wales—which, strange but true, are not convertible terms in railway parlance—are divers traces of Llewellyn, the last Prince of Wales, but we left these unvisited, to inspect the earthworks of Cwrt Llechryd, the etymology of which was matter of some discussion, though we are pretty safe if we take Mr. Thomas's interpretation that Llechryd means the "Flat place of the Ford." The earthworks were to all appearance British, though it is probable that within the area they enclose was a Roman encampment, which may have served for a *station* long, long ago between *Bannium* and the nearest station on the north. I confess I did not quite realise the track of the war-chariots, so convincing to several of our body; but I think none will doubt the existence here of a camp within a camp, such as may be seen frequently in the British entrenchments in the valley of the Axe in Devonshire, occupied at a subsequent date by the Romans, though the construction of a nineteenth century station and junction has rendered harder to trace the stations, in this locality, of our rude forefathers and their subjugators.

From Llechryd we pushed on to a great geological trysting place—Hooper's Quarry—and being met here by Mr. Thomas of Wellfield, were escorted by him to his hospitable mansion and his curiously timbered grounds, a study in themselves by reason of the finely-grown conifers, to a familiarity with which in past years, and a volunteer discipleship to their planter, your retiring President owes one of the greatest pleasures and interests of his vale of life. I ought to say, however, that the interest of the day consisted in a lecture on the geology of the district delivered here, as was well observed, amid groves, hills, and valleys, once the haunts of Buckland, Conybere, Murchison, and Sedgwick, by one who may be said to have earned a title to their descending mantles—our friend and fellow Woolhopian, William Symonds. I wish I could have said the "Oxford Geological Professor"; but, in this case, we may honestly solace our wounded *amour propre* at the preference of another geologist, by the trite Addison, in an adage

> 'Tis not in mortals to command success.
> But we'll do more, Sempronious: we'll deserve it.

I should hold it an impertinence to make extracts from his address, which will be printed *in extenso* in our next volume of transactions, but I will repeat what I have said again and again, as a looker-on and as a president, that there is no savant or professor, of whom I am cognizant, so gifted with the power of arresting and carrying along with him an audience with whom enthusiasm is infectious, as Mr. Symonds of Pendock. Passing over the wind-up of the Builth Meeting, the march to Penkerrig with its oaks and its lake, and the scenery of the district—the Carneddau which we have no time to ascend and the Wye scenery of the charming homeward after-dinner route—it needs but the leap of

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a month to find ourselves on the 17th of July, on our way to Whitchurch and the Doward Caves, again indebted to Mr. Symonds for chaperonage and instruction, whilst exploring the fossil produce of those curious bone caves, which modern geological research has made familiar to us. This was the ladies' day, and a large and goodly company of them and their squires availed themselves of the fine summer weather for an excursion, which after allowing a passing glimpse of Goodrich Court and Castle commence its real interest at the inn at Whitchurch, where, in preface to the ascent of the Doward, Mr. Symonds and Mr. Scobell had arranged in the parlour a splendid collection of the cave bones, according to their quondam proprietors, whether mammoth, rhinoceros, cave bear, hyæna, cave lion, or bos-longifrons, with others. Here, too, were some flint knives and flakes, and the cores from which they had been chipped, at a period far later than that of the prehistoric quadrupedal cave-tenants. The scaling of the hill was too severe a prospect to allow of much lingering over these treasures, yet if any had been disposed to content themselves with the extemporized museum, and without inspecting the *locus in quo* of their finding, they would have missed fine prospects of the Wye, the Forest, the Goodrich, Whitchurch, Ross, and Hereford Country, and, above all, at one particular point of their toilsome march the sweetest view I ever beheld of the Town of Monmouth. It is caught through a valley between the hills, with the Wye towards Dixton to set it off, and I think the painter who could catch and reproduce the vista and the spires and glancing roofs at the end of it would not have to wait for a bid for his picture.

On the western slopes of the Great Doward, Mr. Symonds, who was accompanied by Sir James Campbell, the deputy surveyor of Dean Forest, introduced our company to King Arthur's Cave and one or two others, explaining the several sections, or layers, or floors, which carry us back and below the traces of human handiwork, and the silts of an ancient river, and a second accumulation of cave earth, to the relics of a glacial period and to those wonderful fossil remains in which these Doward Caves compete with Banwell and Cefn and other caves in Great Britain and on the continent.

It should be noticed that the veteran Mr. Moggridge—the custodian and showman, if I may so call him without irreverence, of the Mentone caves—was with Mr. Symonds on this occasion, and afterwards joined our dinner party at Ross. I recall a conversation I had with him at the latter place about his talented son's "Harvesting Ants and Trap-door Spiders," a supplement to which has been recently published by Van Voorst—published too, alas! posthumously; for this acute and painstaking entomologist has been removed by death from the pursuits of science and the study of insect life, to which he was making such notable additions. I will but return to the Bone caves to say that Mr. Symond's valuable account of them was reprinted in the *Hereford Times*, and will find an honoured place in our "Transactions of 1874," and that the Ladies' Day passed off successfully from first to last, owing to the careful arrangements and courtesy of our guides, and those in whose province and property the caves are situate—Sir James Campbell, Mrs. Bannerman, and Mr. and Mrs. Scobell. The botanists,

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too (as our lamented friend Flavell Edmunds told me with gusto), had "a good day."

I pass to our fourth field meeting as one of exceptional interest—the visit on Tuesday, the 18th of August, to Lydney Park in Gloucestershire, and its extensive Roman remains. This was well attended by members of our club, and rendered in the highest degree pleasant and unlabourious by the perfect hospitality of Mr. Bathurst, the proprietor. No sooner did he learn that we meditated a visit to his Camps, and Temple, and Roman Villa, than he not only accorded the necessary permission, but offered to entertain our party at lunch, and undertook our reception in such wise, that we were his guests from the time our train reached Lydney station till we left it in the evening. At Lydney Park, where Mr. Bathurst had invited a party, amongst whom were Sir James Campbell, the (alas!) late Archdeacon Ormerod, the Rev. J. J. Trollope, and other kindred spirits to meet us, we had the prefatorial treat, as at Whitchurch, of a Museum to illustrate the local remains and scenes we had come to inspect—a Museum of singular value, as it contained not only all the evidences of high-class Roman refinement such as you would expect in the villa of a great Roman official and his family, but also three actual inscriptions from the temple, adjacent to the villa, inscriptions decipherable and nearly perfect—inscriptions establishing as clearly as need be that this temple was dedicated to the British or Britanno-Roman Æsculapius, the god Nodons or Nudene, who is supposed to have his name from knots or joints, and to have been much in request in cases of gout and rheumatism. On these interesting relics and the places whence they were found, the several chambers of the villa and temple, which Mr. Bathurst had had unbared for the occasion, that gentleman discoursed lucidly and solidly to us at their respective sites. Neither our reporter on that occasion nor the author of an article on the Lydney Remains in the *Saturday Review* on the 29th of August could speak with such firmness of assurance as one who has so strong hereditary knowledge of and interest in these special vestiges of Roman occupation, and our club cannot be sufficiently grateful to Mr. Bathurst for the thoroughness with which he not only opened to us his treasures, but also did his utmost to make us understand their nature and value. I feel that it is but due to him, before we publish another volume of Transactions—in which will appear a record of the Lydney visit—to submit to his revision the Woolhope notes of it, in order that our report may be worthy of the day, which was one of the pleasantest and most successful in our annals. As regards the inscriptions, an amount of certainty in interpreting them has been realised which is very unusual, and it would be a pity that it should not come forth as nearly accurate as possible in the records of our club. Between Mr. Bathurst's lucid account and Dr. McCaul's Britanno-Roman inscriptions such accuracy may, I feel sure, be approximated, and I shall be very ready to lend a helping hand, of course under correction of one who has an hereditary and personal acquaintance with these interesting memorials.*

I will not linger in retrospect on the silvan beauties of Lydney Park and

* Mr. Bathurst's death, in the fullness of years, since this address was delivered has unfortunately interfered with its supervision.

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the curious interest of a lesser and a larger camp in the precincts of a demesne which is said to have been the envy of the Spanish in the days of Elizabeth; nor will I dilate, lest it should seem fulsome on the hospitable welcome we received from its accomplished and scholarly proprietor, so completely keeping in view the enlightenment of our minds and the refreshment of our bodies. I will pass now to a more local theme, and to what is now, I might say, our great characteristic speciality in the way of meetings—our Fungas Feast and Foray. This was formally solemnised on the 1st of October with the usual rites and ceremonies, but by the beginning of the week mycologists were gathering from far and near, and the preliminary forays, introducing our chief fungus finders by day to the grounds and groves of Downton and the wooded slopes of Dinmore Hill, whilst at nightfall private dinner-tables were rehearsing the crowning hazard of Thursday's fungus feast by cautious experiments on the edibility of toadstools. I cannot say the weather was entirely propitious: indeed, the rain of the early morniug of the first of October damped the ardour of many on whom we counted to accompany us to the delightful precincts and park of Stoke Edith, which by Lady Emily Foley's kind permission we were allowed to hunt over for our favourite game. It damped the ground also to such sloppiness as to be the cause of misadventures to ancles and knees no longer in their first youth. But you will not bid me, I am sure, "*Infandum renovare dolorem.*" Is not the history of the collapse of the President and his mushroom, engraven and written in the truthful pages of the *Graphic*? A very thorough account of the week's proceedings, the visit to Garnstone which finished it included, will be found in the transactions of the year, and thanks to our visitors—amongst whom we lacked through temporary indisposition, the genial authority of Mr. Berkeley—the papers read after our feast, both in the dinner-room and at Mr. Cam's pleasant and now looked-for soiree, atone for a certain dearth of such kind of *pabulum* at the earlier meetings of the year. I shall therefore forbear to touch on the interesting experiences of the fungus week, whether a-field or a-feasting; except so far as to note that the high festival of our great day was graced by the presence of three ladies, all more or less experimental mycologists, all highly successful in the discovery, delineation, or dressing, by deputy, for the hospitable dinners of the Poole, of those edible fungi for which our county is famous. All three successes are in my humble opinion to be envied, and the last not least so; and I think I can plead an authority you will all accept for this averment.

At the close of a pleasant and instructive review of "Fungi: their nature, influence, and uses," in the *Gardener's Chronicle* of March 27, Mr. Worthington Smith not indistinctly sets the vital phenomena of fungi, and (note this) a knowledge of those species which decidedly affect our health or food, above the discovery and determination of the plants as mere species, and as a more remunerating though perhaps less difficult study. The mention of Worthington Smith brings me to one of the two events of our Woolhope year, which make me rejoice in the second year of office. When I recollect how generous, suggestive, helpful, and enthusiastic has been Mr. Smith's assistance to us as a Club and as individuals—whenever we want a fungus named, or drawn, or engraved, or a Herefordshire forest tree

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delineated or reproduced for our transaction pages—when I think what a gain it has been to us last year, for example, to have such a friend at court to win us the permission of the proprietors and editor of the *Gardener's Chronicle* to make use of their blocks of remarkable Herefordshire trees for the purpose of lithographing in the volume just put forth; and then recall the singular modesty which, in his case as in all genuine cases, is the unfailing concomitant of real talent, I cannot but rejoice that in a year when I had the honour to be President, the Woolhope Club deviated from its general rule, and paid Mr. Worthington Smith the exceptional compliment of a handsome testimonial. It is when such marks of respect are thus reserved for rare merit, and are not as every day occurrences, as the nigger's idea of a "collection," that they carry weight, and are the stamp of *bonâ fide* appreciation. I am sure I speak Dr. Bull's sentiments as well as my own when I further say that rarely, if ever, were subscriptions promised or paid so freely and spontaneously as in this instance.

To the other event of our just closed Woolhope year I will advert very briefly. We realized its accomplished fact in our meeting to-day in the Free Library's Upper Chamber, the Woolhope Club Room, the munificent gift of one of our past presidents, who truly recognises the right stewardship of ample means by promoting with them the good and the advancement and enlightenment of others. It is not for me, however, to utter an eulogium on him, but rather, now, to urge my brother Woolhopians to lay-to their hands to assist the formation of a museum, and their heads to the entertainment and cultivation of the readers in the Free Library by lectures, such as Mr. Rankin has set the example of. I would say to them *Spartam quam nactus es orna*, "make the most of a great means of instruction."

At our Fungus Feast we did a bounden and a good deed in admitting to honorary membership several distinguished friends and guests, to whom we owed a debt of gratitude; but before I touch upon this topic, let me not forget that we have lost in last year several distinguished honorary members—some of them more and some less closely connected with our Club. Professor Phillips, Sir William Jardine, and Sir Charles Lyell, are names not to be passed over in our obituary list of 1874-5. The first was called suddenly from his work at Oxford by an accident nearly a year ago; and Oxford lost in him a living pillar of its museum, one whose memorial will, I doubt not, be as enduring there as those diverse-coloured marbles which support its galleries; one too, whose reputation was European, and who had been the main originator of the British Association. In this border city I doubt not there are a few of us who hold it an additional point for commemoration, that he was a Welshman! It is not a little curious that the next in order of our losses—that of Sir William Jardine, the enthusiastic naturalist, illustrates like that of Professor Phillips the general healthfulness of scientific pursuits. Both had passed man's normal span, both were of the age of the century. What Sir William Jardine was to his friends and intimates it is for others to tell. To me he represents as he must to many here, the author-editor of that delightful series, the Naturalists' Library, which, appearing first in days when the world was not flooded with books (bad, indifferent, and here and there good), fed our youthful curiosity, and made us take a livelier interest in the animated nature around us.

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In Sir Charles Lyell, whose death in February last removed from the scientific circles, which he adorned, an almost octagenarian, many of our living geologists will have lost their first guide to the principles of their favourite science, and their best counsellor in their maturer researches. I suppose, too, that even an outsider like myself may be allowed to bear testimony to one characteristic in which his great works are unequalled—their peculiarly lucid style. This is a sure key to popularity, as indeed, considering the quantity of various work the well-informed man has now-a-days to squeeze into his curriculum, it well deserves to be.

Well! all these men of mark were amongst our Honorary Members: as was also one, less known, less great, but more local to us, a clever man, a kindly soul, a pleasant and congenial fellow-rambler—on a Woolhope field-day, our friend Flavell Edmunds. He, too, is taken. He rests from his labours: but I think that few of us will forget the enthusiasm he imported into any meeting he attended, the multifariousness of his knowledge, whether the matter in hand was local nomenclature, or field botany, or the seats, stones, and vestiges of the never-dying King Arthur. Most, too, can testify that he exhibited in disputation an excellent temper, and could agree to differ without looks of offence. Let us hope that, where freed from life's fitful fever he sleeps well; no echoes reach him of newspapers' criticism, calculated to disturb, as fables tell us very second-rate creatures may do, a sleeping lion.

But—*uno avulso, non deficit alter*—and in the case of the first and foremost of our Honorary Members of the new creation—I think I may add Virgil's epithet, "*Aureus.*" Certainly Mr. Berkeley, the Nestor of Mycologists (unless, indeed, I am to endorse Mr. Worthington Smith's fancy, and call him the "Agamemnon of Mycenæ"), deserved at our hands the highest honour at our bestowal, and that not only for his countenance and support in the Autumn of 1873 to our mycological foray and festival, but (shall I say) for the *even more* practical kindness he has spontaneously shown to our society in the matter of the apple-grafts which, as Chairman of the Fruit Committee at South Kensington, he so liberally and generously sent us in furtherance of our project of improving the pomological table-fruit of Herefordshire. That seasonsble and substantial kindness—for it amounted to no less than 97 grafts—I duly acknowledged in my capacity of President at the time; but it also claims notice in this address, which would be of no use if it did not commemorate benefactors and benefactions. It is, I know, a poor compliment to so eminent a naturalist and botanist, the member of so many societies, to enrol him amongst our field folk; and yet I cannot help thinking that, if we use the gift he has been instrumental in procuring for us aright, he may perchance see some of the fruit of it; if not, *carpent ea poma nepotes*, or in simple English, "the fruit of it will live after him."

I look to our friend Dr. Bull to take up this question more in *extenso*; but I recommend to you, in passing, a plan which he has already broached to me in private, of circulating among garden-loving cottagers, through the medium of the parochial clergy, some of the young trees which, since Mr. Berkeley's kind intervention, a local nurseryman has grafted for us. On this head I will only say that,

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so far as my experience goes, a petty freeholder, with his orchard of cider fruit, is a very likely man to harvest his fruit, make his cider, and then drink himself drunk upon it, doing no more work till he sees the dregs of his cask. But replace his cider apples with pot fruit or table fruit, and you at once point the way to a profit and a reserve fund. And in the case of a renting cottager, you probably point the way to the rent as well as something more. I myself once realised this fact—*apropos* of one of my own cottage lettings—in the evidence of a tenant in the Assize Court at Hereford.

But I am wandering from our Honorary Members. Let Mr. Berkeley stand A 1 of the new list. After him come names well known to botanists—Mr. Broome, Mr. Rennie, Mr. Houghton, Mr. Plowright, and Mr. W. Phillips—and all names worthy of high reverence from us, who know how much light they throw upon our autumnal rambles in quest of what the uninitiated are disposed to regard as our chronic delusion. Be that as it may, we honour them, and rejoice if they deem that so small a token as our opening our ranks to admit them as Honorary Members, in any slight degree evinces it. If I might be allowed to suggest an additional Honorary Member or two—and I don't think that such a suggestion is without precedent (for retiring Premiers make batches of baronets, and often a peer or two to boot)—I would suggest that in another portion of the field over which our society ranges we might do ourselves good service, and and pay withal a merited compliment to men like-minded with ourselves. The list of our archæologists would be advantageously supplemented by the names of the Rev. W. Bevan, of Hay, joint editor with Mr. Phillott in the volume elucidatory of the Mappa Mundi, and the Rev. T. W. Webb, of Hardwick, the son of the most remarkable of Herefordshire antiquaries, and the competent editor of the works of his sire. I cannot help thinking that my congenial successor, during whose Presidency we are likely to break out freely into archæology, will aid and abet me in this proposition, and I ask those who cherish the old memorials of our forefathers in the district our club embraces, of their sympathy to support it.

What I think in the retrospect of 1873-4 we have most lacked is a large and diversified supply of papers, to be read, or to be taken as read, and then printed in our transactions. In archæology this was very conspicuous, and if my able successor will direct his attention to the cure of it, I doubt not this fault will disappear. It is the same, however, with other and more primary branches of our society's scope and object. With the exception of Mr. Rankin's paper on Rodents at the last annual meeting, during the last year there have been few after-dinner papers read, except on the evening of our fungus feast, and on mycological subjects. Yet there are, I know, volunteers on ornithological subjects, on entomological (as we have seen in Mr. Lane to-day), and on botanical to any amount, who only want the assurance that we shall be glad if they would assist us in their own line, to take up some special feature, or section, or aspect of their favourite subject. Such papers are the germ of, or the vestibule to, more thorough compositions, and, if we could know it, many of our greatest works in science and literature were developed from the tentative and unpretending essay.

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I should be glad to hear that our microscopists were ready to give proof of their work in some contributions to our papers, and I leave the (I have no doubt) easy task of eliciting such, as a legacy to the new President. Several things have fought against us in the year past, and the delays of publishing our long-promised volume—delays over which the President and the Committee had no control or remedial power—operated as discouragements to the collection of papers, as to which it was uncertain when they were likely to see the light. At last our volume is launched, and this I must say in candour, owing very much to the staunch and magnanimous way in which, as ever, Dr. Bull has taken the working oar. In experience, in resource, in real wit in cases of difficulty, but above all, in hearty helpfulness I have never met his equal. Mr. Clark, of Eaton Bishop, too, deserves my thanks for valuable and timely assistance. I think the Editorial Committee should address itself to the discovery of a better mode of publishing our transactions in future; and that it would be well if our finances, which are hopeful, were revised by a collateral sub-committee. On the whole, and in conclusion, I see much whereupon to congratulate the club. Our numbers grow; there are no schisms in our body; we have a local habitation found, and a museum in prospect. Our reputation as a field club is so extended that the Natural History Societies of Bristol, Dublin, and Berwick-upon-Tweed write to us ever and anon through their Secretaries to ask for our new volume of transactions.

I believe that Mr. Isbell's movement in reference to a pair of thermometers and a rain guage at the Free Library has been taken up and carried out, and I am glad to think that we have satisfactorily accomplished a modest scheme of prizes for the encouragement of young naturalists.

A prize for dried plants was awarded in January last to Miss Edith Jones Thomas, a daughter of one of our most active members, and also a smaller prize to a young Herefordian for a collection of bird's eggs. So much for the past. The future of the club ought not to be doubtful. I could name, were it not invidious, half-a-dozen or a dozen members who have not yet filled the office of President, yet who, if elected to fill it, as the years come round, would adorn the office and impart life, method, research, prestige to the doings of the club. For myself, I have striven in my two years' term, to make up for defects of special knowledge by accessibility to every member, and a study to understand and carry out the wishes of the whole body; and I am vain enough to think that I have not wholly failed. But if this is so, a great part of the secret has lain in the ready help and great encouragement I have met with from every officer and every member of the Woolhope body, and in their loyal principle of lightening their President's labours by confidence and support.

After the President had concluded, the Rev. W. Bevan (Hay) and Rev. T. W. Webb (Hardwick) were proposed by the President (Rev. Jas. Davies) and seconded by the President elect (Rev. C. J. Robinson), and unanimously elected honorary members.

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THE WOOLHOPE NATURALISTS' FIELD CLUB.

At the recent meeting of the Woolhope Naturalists' Field Club, the following interesting paper was read by THEOPHILUS LANE, Esq., of Hereford :—

BRITISH SPIDERS.

One summer's afternoon, while hunting for insects in my garden, I saw one of the beautiful metallic coloured flies caught in a spider's web on a rose tree, and the spider was running out to catch it. Having at the time a powerful condensing lens with me, I focussed the rays of the sun close to the fly, so as to prevent the approach of the spider to her prey, and was curious to see what she would do. Directly the spider felt the heat she ran back again, then in a few moments made a second attempt, when using the condensor as before, the same result followed. My friend was not to be daunted, for after waiting a few seconds she again rushed out to the struggling fly, but still finding the focus unpleasantly hot, she hurried back from it. I still watched the spider closely, and was surprised at the ingenuity of the next move she made. She stood at the entrance of her nest, for a moment as if to consider the matter, and then ran down to a lower branch of the rose tree, and along the outer line of the web, so as to be able to get at the fly in the opposite direction. Being struck with admiration at the intelligence thus shown, I took away the condensor and allowed her to secure her prize, which she did, and then most intelligently mindful of her former difficulty, she carried it back by the same indirect way she got to it. I afterwards felt a sort of friendship for this spider, and supplied her with a fly or two nearly every day for some little time, but one morning going as usual to feed her, the web had been destroyed, and the spider was gone.

From this time the spider tribe has proved to me a never-ending source of interest and pleasure; and I have been induced to draw up this paper in the hope that other members of the Woolhope Club may be led to seek the same gratification in the study of their character and habits. British spiders are very numerous. They are divided into two tribes. The first, or eight-eyed tribe, consists of ten families, and the second, or six-eyed tribe; consists of two families, and of these several families of true spiders there are many hundred genera known. Spiders are also popularly divided into the "sedentaries," or those who spin a net and wait for their victims to get entangled—the house and garden spiders for example—and the "vagrants" and "hunters," who use no net, but lie in ambuscade, or roam about and spring upon their prey at some unexpected moment and thus resemble more closely the larger beasts of prey. Besides, there are other members of the arachnida family—the harvestman and the little red spider for example—which, though closely allied to them, are not spiders proper.

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Spiders are not true insects. They rank higher in the scale of creation than the largest and *most* powerful insect. The breathing organs, the circulation, and the mode of reproduction are far superior to those of the twelve orders of insects. The fear and dislike to spiders is very general, and it must be admitted that the prejudice is natural; their very appearance, their ugly, ungraceful form, at once creates it, as has been rightly said :—

> Their shape would make them, had they bulk and size,
> More hideous foes than fancy can devise.

In the first place, it will be well to consider their structure. The body of the spider is divided into two parts. The fore part is formed by the head and chest united, and to this the legs are attached. This is called the cephalothorax, the hinder part is called the abdomen, and contains the organs of animal life. The upper side of the cephalothorax has a covering called the shield, whilst the covering of the under side is called the breastplate. The shield and breastplate greatly differ in form in the different species. The eyes are situated on the shield. They are simple, and the grouping of them is of vast importance to assist in distinguishing the genera. They are sometimes stalked so as to be enabled to see above the mandibles which in some species are very long and curved. It is said, like cats, they can see by night. Below the eyes and above the mouth is a pair of jaw-like organs known as forceps, falces, mandibles, or poison fangs, and terrible fangs they are. In all the English genera, except the crab spider, the poison fangs are attached to the face by joints, either in a perpendicular position or with a slight inclination towards the breast, and have a movement like the jaws of insects. In the crab spider they are horizontal, and move up and down; they are composed of two parts, the base and the fang. The fang is hard, sharp-curved, and moveable, and is attached by a joint which has a groove on the inner edge, into which the fang is folded down when not in use. A row of teeth is generally on one or both edges of the groove. Their object is to catch and hold the prey, which they also poison. The poison gland is at their base. The poison is of an acid nature, as we may learn by making a spider angry and holding a piece of litmus paper to him, which he will bite, causing the paper to turn red, as far as the fluid emitted extends. The mouth is furnished externally with an upper and under lip, and a pair of jaws. These jaws are placed in each side of the lower lip, and are furnished with a pair of long palpi or feelers, which vary in the two sexes. In the female they resemble small legs, and have one very small toothed or plain claw at the tip. In the male the terminal joint is very much enlarged, and presents a complicated structure. The legs are eight in number, and are connected by joints to the cephalothorax. The foot has two, three, or more curved claws, toothed like a comb, though they are met with plain in some species. The first objects to be noticed in the hinder portion of the spider's body are the breathing organs. These consist externally of two or four brown, white, or yellow scales, having a small transverse slit at their hinder edge. These breathing holes are of the nature of true gills. The layers which compose them are best to be seen in specimens which have been dried, or over which boiling water has been poured.

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The heart of the spider is of a spindle shape, furnished with valves. It sends off arterial branches through which the blood circulates. The last, but by no means the least important part of the structure of the spider, is the spinnerets. These organs are of great interest. They are placed at the extremity of the abdomen, clustered together, and consist of two, three, or four pairs, are jointed, and differ in form and length. In some they are cylindrical, the upper pair being very long and having a free motion; in others they are nearly equal in length, short and cylindrical, or conical; while in others they are short and bent towards each other, and look much like a rosette. The sides of the cones are covered with hairs, and on the summits are a number of fine horny tubes, at first sight resembling hairs. These form continuations of the spinning vessels. Sometimes the lower portions of the sides of the cones are furnished with spinning tubes, the remainder being covered with hairs. Each tube consists of two parts, a thick basal portion and a thin terminal portion, from the orifice of which the substance of the fibre exudes. The number of these spinning tubes differs according to the species, sex, and age of the spider.

In the garden spider there are more than a 1000 to each nipple or spinneret. In others 400, 300, 100. These spinnerets contain a viscid fluid, a kind of elastic gum which becomes hardened by exposure to the air, and is expelled at the will of the spider. From this viscid fluid the web filaments are formed, and as the filaments from each spinneret are projected outwards they agglutinate together to form a perfect thread, and thus each thread is composed of at least 4,000, and sometimes 6,000 filaments. It is affirmed that a filament is so slender as to require 4,000,000 to make up a thread as thick as one of the hairs of a man's beard. Kirby and Spence also say that "The holes in the spinnerets are so fine and so crowded together that there are 1,000 of them in the space covered by the point of a needle. These filaments unite about the tenth of an inch from the spinnerets to form the thread with which the webs are made." The strength of the web varies greatly. The threads of some exotic species possess a far greater power of resistance than ours do. Travellers state that in some countries spiders' webs are so strong as to arrest humming birds as a net would, and that a man only breaks them with difficulty. Dr. Livingstone says, "In some parts of the country (Africa) there are great numbers of a large beautiful spotted spider, the webs of which are about a yard in diameter. The lines on which these webs are spun are suspended from one tree to another and are as thick as coarse thread. The fibres radiate from a central point where the spider waits for its prey. The webs are placed perpendicularly, and a common occurrence in walking is to get the face enveloped in them as a lady is in a veil. Another kind of spider lives in society and forms so great a collection of webs placed at every angle that the trunk of a tree surrounded by them cannot be seen. A piece of the hedge is often so hidden by the spider that the branches are invisible. Another (species) is seen on the walls in the inside of the huts among the Makolols in great abundance. It is round in shape, spotted, brown in colour, and the body half-an-inch in diameter. The spread of the legs is an inch and a half. It makes a smooth spot for itself on the wall covered with

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white silky substance. There it is seen standing the whole day, and I never could ascertain how it fed. It has no web but a carpet, and is a harmless tho' an ugly neighbour."

In Central Africa there is a spider which makes paper of a very fair quality. After selecting a spot for her nest she walks backwards and forwards over a square inch of surface until the space is covered with pure white paper; in this she places from 40 to 50 eggs, she then makes a strip of paper about a quarter of an inch broad and with it carefully glues the square together. She wages a fierce war with cockroaches or any other insect that comes near. After three weeks of unremitting watchfulness, she leaves her nest in the day-time to hunt for food, but she always returns at night until the young are strong enough to cater for themselves.

The colour of the silk of our spiders is mostly of a dirty grey, but in tropical countries the colour varies, red, yellow, and black, and with these they form a tri-coloured web, which they interweave with great skill. The threads forming the webs of spiders are not all alike. The radiating filaments are but little elastic, and are composed of one thread, whilst the more numerous concentric, or spiral circles, are extremely viscid, and the reason is this:—The threads of the cables and radii are perfectly simple, while the spiral threads are closely studded with minute globules of fluid like drops of dew which, from the elasticity of the thread, are easily separated from each other. These globules are very viscid, as can be easily proved by touching one or two with the finger, to which they instantly stick, or by throwing a little dust over the web, when the spirals will be found clogged with dirt while the radiating lines remain unsoiled. The viscid lines alone have the power of detaining unfortunate clients when they accidentally touch the web. Blackwell states that in a web of an average size there are as many as 87,360 pearly drops, and in a snare of 14 to 16 inches diameter there are 120,000, and yet a spider makes such a web as this, if not disturbed, in less than three-quarters of an hour.

There is scarcely a more interesting sight connected with this part of natural history than to watch a spider begin and finish its web. Take a female *Epeira* or garden spider for instance, and suppose she has selected the most favourable spot she can find for her home under a leaf of a rose tree, where she makes a silken gallery, most frequently open at either end, to enable her to rush forward or retreat with equal facility. The next step is to extend a horizontal line between the branches. To enable her to accomplish this she exposes her spinnerets to the air and expels the fluid lines. The air drives them forward and they come in contact with a neighbouring branch, to which they adhere by their own stickiness. This is the beginning of the framework, which is finished by her ladyship dropping and swinging from point to point, or at other times, assisted by the air, she places a thread wherever she touches. The framework finished she comes to the middle of the horizontal line, attaches a thread to it, and drops on to the line which forms the lowest side of the framework; here she fastens the other end of the thread. She next walks up till she reaches the middle, and this is to be the centre of the snare, and here another thread begins. She then runs up the

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perpendicular thread, and draws out the new one as she proceeds till she reaches the upper line, which she runs along to the spot which she sees fit to fix a radiating line to the web. She then returns to the centre and repeats the same process each time walking up the last formed radiating thread till the whole area is filled with radiating lines. In some instances the spider forms the radiating lines on the opposite sides of the web alternately. Having finished the radiating lines, she now begins the spiral lines, or the meshes of the net. She goes to the centre of the web, fixes a thread; she then turns round, drawing the viscid fluid from the spinnerets, which she attaches to the radiating lines with the assistance of the hind legs. She goes further and further from the middle, until the spiral line extends to the circumference of the web, where she places another thread and reverses her method of working by drawing a second spiral line from the circumference to the centre. From her nest a strong line runs to the centre of the web, this web not only forms a path but tells her when a victim is caught, the motion of the line caused by its struggles being thereby communicated to her in her home—

"The spider's touch, how exquisitely fine,
Lives in each thread, and feels along the line."

It is well known that spiders leave the nest and make snares for themselves when very young. An eminent naturalist states that a young epeira seven weeks old makes a web the size of a penny which has the same beautiful symmetry as that of a full grown spider. And the question is asked—Do the young spiders build their first nest by instinct? that is to say, independently of all teaching or personal experience, or do they copy the nests in which they were hatched? But there is no doubt they are taught by instinct from observations that have been made.

Spiders keep their webs remarkably clean, otherwise, owing to the viscid portions of the spiral threads, they would be very often stuck over with foreign substances, which would in all probability warn the flies of their danger, therefore the spider is generally found cleaning or strengthening the web. If there is too large a piece of rubbish in the web for her to clear away, she cuts the meshes out which contain it, and drops it all to the ground. At other times, finding some of the threads very dirty, she rolls them up in a small compass, and drops them out of the web to the ground. When she lets herself down by a line to ascertain the strength of the web, or the nature of the place below her, on her return she always coils the line into a little ball and flings it away, and her claws, as we have seen, are beautifully adapted for these purposes.

To watch the female house-spider prepare her nest, or cocoon, for her eggs, is very interesting. Nearly, if not all, the species cover their eggs with silk, forming a round ball. The mother spider uses her body to measure the size and form of her nest in the same way as a bird does. She first spreads a thin coating of silk as a foundation, taking care to have this circular by turning her body round and round during the process. In the same way she spins a raised border round this foundation, till it takes the shape of a cup. She now begins to lay her eggs in the cup, and not being content merely to fill it even with the top of the cup, she piles up a large round ball of eggs as high as the cup is deep. The under half is covered and protected by the silken sides of the cup, but the upper eggs are still

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bare. She next begins to cover these by spinning a thick web round them, and when she has completed this task there is a ball of eggs much larger than her body. The eggs are beautifully marked.

Nothing can exceed the affection the female spider has for her cocoon. It is the one great and amiable trait in her character. Those spiders who carry their eggs about with them will sooner part with life than their bag of eggs. When it has been taken from them by force and placed at some distance, they have been seen to take them up and fasten them to their bodies with the greatest care. Bonnet, the naturalist, says that he one day threw a spider with her eggs into the pitfall of an ant-lion. The spider tried to escape, but he threw her again to the bottom, and the ant-lion, being more nimble than he was the first time, seized the bag of eggs with its jaws, and tried to drag it under the sand. The spider made the greatest efforts to keep her eggs, but the gum which fastened the bag to her not being strong enough to withstand such violence, gave way, and the ant-lion began to carry off his prize. But again the mother seized it with her jaws, but the ant-lion being the strongest, dragged it under the sand. The mother, robbed of her eggs, might have saved her life, as she could easily have escaped—but she chose to be buried alive along with her eggs—as the sand concealed what was going on below, the naturalist laid hold of the spider, leaving the bag with the ant-lion. But the affectionate mother would not quit the spot where she had lost her treasure, and life seemed to have become a burden to her.

The same naturalist also observes that he tried his utmost to beat off a spider from her bag of eggs, after he had detached them for a long time; at last, to his surprise, he found she no longer resisted, and when he put the cocoon near to her she retreated from it. On closer examination he found that several of the young ones were hatched, and their numbers increased so rapidly, and they all ran towards their mother, and climbed upon her body, some on her back, others on her head, and many on her legs, so that she was completely covered with them, and appeared to bend under their weight, not so much from being overladen as from her feeble condition, and she very soon died, while the young spiders remained in a group upon their parent to suck the juices of her body. Afterwards Bonnet tried to prove whether a spider of the same species could distinguish her own eggs from those of a stranger. He interchanged the eggs of two individuals, which he had placed under inverted wine-glasses, but both showed great uneasiness, and would not touch the strange bags. One of the mothers was then placed into the glass containing her own eggs and the other spider, but even then she would have nothing to do with them, which was believed to be in consequence of the presence of the other, as all spiders nourish mutual animosity. However, upon removing the stranger, she showed the same indifference to her eggs, and it was concluded that after having lost sight of them for a short time she was no longer able to recognise them.

Nearly every one has noticed fine floating webs, which seem sometimes to cover the earth, and almost fill the air, on still summer and autumn days. These webs are produced by the Gossamer Spider. In favourable autumns they are

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found in myriads scattered and borne everywhere on their airy webs miles distant from their starting point. These little creatures have the power of shooting out lines of gossamer from their spinnerets, so as to render themselves buoyant and lighter than air; and these lines are carried upwards and onwards by aerial currents, and convey the little spiders with as much safety as if they had wings, and hence they are popularly called "Fliers." They can coil and thicken the lines in the air, and by this means, as well as by the lines crossing and tangling with each other, the webs are sustained in the air, and cause us much discomfort when we find our faces suddenly covered with this filmy veil. White, of Selborne, tells us he was one day prevented from hunting, the dogs being blinded with the webs. Towards the end of October, meadows, hedges, stubble-fields, and even whole districts appear covered with a fine, spangling, silvery gauze. These little creatures do not make webs, but extend their threads from one place to another. The threads are so fine that we cannot see them unless the sun shines upon them. One of them to be visible at any other time must be composed of at least six ordinary threads twisted together. In the fields a person with a quick eye, or by the assistance of a lens, may frequently see among the stubble, grass, &c., such a multitude of these little fairy weavers extending their threads that the fields appear to be alive with them—

> Stretched from blade to blade,
> The wavy net-work whitens all the field.

When several of the single threads become tangled so as to form flocks and balls, they are known in Germany by the name of "The Flying Summer," because the summer seems to fly away at the same time. The gossamer elevates its spinnerets, sends forth its thread, and sails away faster than the eye can follow it. The uses to which spiders and their webs have been placed are very various. They have been used in medicine from very early times. Albin, the author of "Natural History of Spiders, 1736," says that Dame Hughes, of Tottenham Court Road, had a Tertian ague for three years, and that he cured it by giving her the web of the house spider mixed with mithridate. He also states that he has cured several children of ague by hanging a large spider confined alive in a box about their neck, reaching to the pit of the stomach, without giving any internal remedies. Dr. Watson in 1760, made trial, by the advice of Dr. Gillespie, of the web of the cellar spider, with great success. He also made his patients swallow spiders gently bruised and wrapped up in a raisin or spread upon bread and butter, also keeping a spider suspended from the patient's neck till it died. Dr. Gillespie afterwards advised Dr. Jackson to make use of it, and in 1801 he cured many cases of ague with it. Here the question may be asked, might not these cures have been the result of fright? Granted, we know there have been cures effected by terror, but still thanks are due to the spider, be the cause from what it may, the beneficial results that have been mentioned were the same, and we must feel convinced that it was more disagreeable to the spider than it was to the patient.

Shakespeare, in "Midsummer Night's Dream," alludes to the web stopping bleeding. In the first scene of Act the third he makes Bottom say, "I shall desire you of more acquaintance, good Master Cobweb. If I cut my finger I shall make bold with you."

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The mandibles of the great crab spider, Wood says, are so large that they are removed from the creature and set in gold and used as toothpicks as they are believed to possess virtue enough to drive away the tooth-ache.

The most serious obstacle in making the silk of spiders useful is that the creatures themselves are such dreadful cannibals, which makes it practically an impossibility to keep them. Place a large (or any) number in a box, and they will soon be reduced to one or two. Finding, a long time ago, some very pretty spiders, and not knowing anything about them, I put them in a box, covered it with gauze, and gave them some flies; but, though they had the flies, they preferred to eat each other, and the flies were not touched. The survivor was in such a mangled state I killed it.

It has been estimated that 27,648 females are required to make one pound of silk, whilst 2,304 silk-worms will make the same weight. True, instances are recorded of spiders' silk having been turned to account. Louis XIV. had a dress made of it; but its want of strength soon disgusted him, though the silk of some of the American spiders possesses power of strength to admit of its being made use of. Al D'Orbigny had a pair of trousers made of it, which lasted a long time. Next, a Mr. Rolt received a medal from the Society of Arts for obtaining silk from the garden spider. The gossamer was obtained directly from the spinnerets, and not from the egg, or cocoon silk. He connected a small reel, with the steam-engine of the factory in which he was engaged, and putting it in motion at the rate of 150 feet per minute, found that a full-grown spider, would, during from three to five minutes, continue to give an unbroken thread. The specimens of this silk which Mr. Rolt presented to the Society, were wound off from 24 spiders in two hours. Its length was calculated at 18,000 feet, the colour white, and the lustre was of metallic brilliancy, owing most likely to its great opacity.

In 1797 a work was published by Quatre Mère Disjouval on Arachnology, or the art of interpreting weather, from changes in the webs and motions of the spiders. The author had beguiled the weary hours of his imprisonment by watching the movements and proceedings of spiders, as connected with atmospheric changes, and had thus obtained the materials for his work. And in times more recent, *Una bella ragna* on his dungeon wall became the pet of Silvio Pellico, and was thus useful, so to speak, in providing consolation to the mind of the unhappy prisoner.

In Jamaica, spiders are encouraged in dwellings, since they are found to be very useful in keeping under the cockroaches; and a humorous gentleman, living in London, writes in *Science Gossip* that he keeps a spider in his bedroom to kill the pestilence that walketh in darkness. It has been observed, that the female epeira has completed her ten changes of skin in about six months (one of which takes place in the cocoon) and at the end of eight months she is 2,700 times as heavy as she was at her birth. The slough is cast in the most perfect condition, with every hair, the fangs, the feelers, the legs with all their joints, and even the cornece of the eyes. It can be examined readily, and with a good cleaning and drying makes an excellent object for the microscope. The moulted skin can generally be found close to

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or in the web. This is far better than trying to prepare a spider for mounting, as it requires great skill and patience in dissecting. Should a spider lose a fang or feeler, or any other part, it is reproduced and grows larger every fresh moult till it reaches its proper length. It has not been ascertained how long spiders live. Many writers say four, five, and more years. I have known one to live three years, and then it came to an untimely end. The Cardinal spiders are the largest we have in England. One was weighed in Gloucester some time ago, and the weight of it is said to have been close upon half an ounce. The chicken spider of South America, however, is described as being as large as the fist. It measures an inch across the head part, and spins a cocoon three inches long and one broad. It is not certain whether it belongs to the hunting or working spider. The muscular force of this spider is so great that it is very difficult to make it let go the object which it has seized, even when the surface does not allow of a purchase either to the hooks with which its feet are armed, or to the fangs which it employs to kill the birds and the tree lizards. The pugnacity and hatred which it shows in fighting stop only with its life.

A spider has lately been discovered in Assam, and has been described before the Entomological Society. "It is as large as a small mouse, and is capable of making a noise, which is produced by rubbing together some of the organs attached to the mouth, the sound is grating, its bite is very venomous. It is named Mygale Stridulans."

With regard to the *senses* of spiders not much is known. They have those of sight, touch, and taste. These two latter organs are situated in the feelers, and anecdotes are related which seem to show that they have hearing also. It has been affirmed that spiders have come down from the ceiling during concerts and returned directly the music ceased; and a specific instance may be given of a gentleman who used to play the piano every evening at a certain hour, had always an auditor in the shape of a spider, who stationed itself on the instrument as long as he played, and ran away directly he finished. In this case, however, the musical vibrations may have been felt as readily as they were heard. It is different, however, with this anecdote. M. Pellison, when a prisoner in the Bastille, tamed a spider in his cell, and taught it to come for food to the sound of his flute.

Spiders possess great *intelligence*, as has already been shown. It will be further proved by the following anecdote:—Wood, in "Homes without Hands," gives an account of an ingenious method adopted by a garden spider on a tempestuous day. He says: "These spiders have a most singular plan of strengthening their web when the wind is more than ordinarily violent. If they find that the wind stretches their nets to a dangerons extent they hang pieces of wood, or stone, or other substances to the web, so as to obtain the needful steadiness. I have seen a piece of wood which had been thus used by a garden spider, and which was some two inches in length, and thicker than an ordinary drawing pencil. The spider hauled it to a height of nearly five feet, and, when by some accident the suspending thread was broken, the little creature immediately lowered itself to the ground, attached a fresh thread, ascended again to the web, and hauled the piece of wood

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after it. The spider found this balance weight at some distance from the web, and certainly must have dragged it for a distance of five feet along the ground before reaching the spot below the web. There were eight or ten similar webs in the same verandah, but only in this single instance was the net steadied by a weight."

The perseverance of the spider is proverbial, and is shewn in all her actions —in spinning, in cleaning her web, in attacking her prey, or in endeavouring to accomplish any object that she has set her mind upon. Man may learn a lesson here; and it has been learnt, at least on one memorable occasion, if history is truthful. The Scottish hero Bruce, when hiding in a cave from his enemies, took courage from the perseverance of a spider. He noticed that it failed six times to attach its thread, and still made a seventh effort, which was happily successful. He may thus be said to have hung his own decision and the fate of Scotland on the persevering efforts of a spider.

Chambers in "Anecdotes of Spiders," says, "Upon throwing a large lively fly on a very large net in front of a summer-house, which was trellised with a rose-bush, the spider was sheltered in a crevice, but the web was open and free. The fly was no sooner on the net than the spider was instantly out, threw round the buzzing wings of his game a few coils of gossamer and then seized him and struck the fatal wound. By struggling, the fly had entangled itself pretty largely in the net, so that it could not be dragged to the den without rending the net from the centre to the circumference. The spider perceiving this dilemma cut the surrounding meshes and the fly fell, not to the ground however, for a strong thread had been provided and it merely dangled a few inches under the net. The spider then hurried to the mouth of its den and drew up the fly without difficulty or impediment—could human reason have done more?"

Wood gives the following account of a battle between a spider and a cockroach, he says: "In this case the cockroach struggled furiously and was nearly escaping had not the spider bethought itself of a new manœuvre, we had noticed him frequently attempt to bite through the sheath armour of the cockroach but he seemed to have failed in piercing it. He now seemed determined to catch the two fore legs that were free. After twenty trials at least, he noosed one of them and soon had it under his control. This pair of legs was more delicate a great deal than the others; he instantly bit through the captured one. The poison was not sufficient to affect the large mass of the cockroach a great deal, but the leg seemed to give it much pain, and it bent its head forward to caress the wound with its jaws, and now the object of the cunning spider was apparent. He ran instantly to the old position he had been routed from on the back of the neck, and while the cockroach was employed in soothing the smart of the bite, he succeeded in enveloping the head from the back in such a way, as to prevent the cockroach from straightening it out again and in a little while more, had him bound in that position and entirely surrounded by the web. A few more last agonies and the cockroach was dead, for the neck bent forward in this way, exposed a vital part beneath the sheath, and we left the spider quietly feeding upon the fruit of his weary contest. The battle between brute force, and subtle sagacity, lasted one hour and

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a half. It is a pity it could not have been added that the spider immediately invited his friends and neighbours to the feast, but observation as yet, records no such instance. Spiders as they have the power of fasting for months without apparent injury, so can they gorge themselves inordinately when they have the opportunity. A naturalist writes, "Some years ago, when living in a lonely way, I took pains to cultivate the acquaintance of a remarkably well developed spider, who had formed a symmetrical web in one corner of my room. In order to propitiate his favor, I fed him with such food as I thought best adapted to his taste, and after a while he seemed to rely entirely upon me for his supplies, relapsing, as human beings often do, under similar circumstances, into luxurious ease and inactivity. One morning by way of testing his temper, I threw a small piece of wet tobacco into his web. He supposing it to be his usual morning fly, rushed towards it with hungry avidity, and instantly ran away to a remote corner of his premises with still greater velocity. I was aware that the presence of such a nauseous substance as *this* in his domicile would be very offensive, and I also knew that he would not venture so near a second time as would be necessary in order to remove the article, and my curiosity was excited to see what course he would pursue. After awhile he crawled to the upper part of his web, and shook it with all his might but was unsuccessful in dislodging the offending substance. He then returned to his accustomed place in the centre of the web, and for a few moments appeared to be thinking the matter over. At last he stepped out with an air of confidence that satisfied me he had hit upon something, altho' I was unable to conjecture what it would be. True enough he had solved the problem, and accordingly went to work to sawing away a circle round the tobacco until the whole concern fell out altogether. After which he repaired the damage, and all was right again. I think, however, that from this time my spider friend never gave me his confidence."

A spider attacked an ant into the body of which he plunged his poison fangs, he at one recoiled showing signs of great distress, left the ant, which was not dead, and running to an earthern flower pot seized its edge between his fangs and remained some time in this position. At length he let go his hold, leaving on the surface of the pot a wet blotch more than half an inch in diameter, went back and finished killing the ant. He had evidently imbibed some of the formic acid from the ant and that was the mode in which he sought and found relief.

Some time ago I fed a garden spider occasionally, but one day while smoking my pipe I treated her to a puff of tobacco smoke. She immediately let herself down some distance from the web, and remained motionless for a few moments. She then ran up again as fast as she could, cut her web all to pieces so that it was hanging in shreds, and then left the spot. I felt sorry for what I had done.

Dr. J. Lawrence Hamilton gives the following incident of the spider's instinct which he witnessed :—"A boy removed a small spider to place it in the centre of a big spider's web which was hung among foliage, and distant some four feet from the ground. The large spider soon rushed from its hiding place under a leaf to attack the intruder, who ran up one of the ascending lines by which the

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web was secured. The big insect gained rapidly upon its desired prey. When the little spider was barely an inch in advance of its pursuer, the small spider cut with one of its posterior legs the line behind itself, so that the stronger one fell to the ground, thus affording time and opportunity for the diminutive spider to escape along the ascending rope of the web.

Many similar anecdotes might be given to show their sagacity. Spiders in common with many other animals above and below them, are often observed to assume the appearance of death. They draw up their legs, and roll helplessly down, and will even allow their bodies to be injured with Spartan or Indian equanimity without throwing off the deceit until they believe the danger to be past or suspect the deceit to be found out.

The loves of the spiders is a tragic chapter. To all who choose to watch them closely, this subject will prove one of unflagging interest. Spiders scorn "the gentle dalliance of love." The affection of the mother seems to exhaust itself in the love for her eggs; she cares little apparently for her own lover. The gentleman spider, always much smaller than the lady, runs a most terrible risk in his wooing. Should his attentions not be well received, woe betide him. He will require his utmost activity to prevent being eaten up wholesale without remorse. Should his attentions be accepted, the danger is scarcely less great. He is obliged to be exceedingly alert to escape his lady's ferocity. This is said to account for the small number of males in comparison to the females. It is computed that there are nearly one hundred females to one male spider. If the eggs of the female were not so numerous, and if she did not exert her utmost care to save them, spiders might probably become extinct.

"Gloomily retired
The villain spider lives, cunning and fierce."

The general character of the spider will have been gathered already from the many observations that have been given. Their ugliness, their ferocity, their selfish unsocial habits, their life-long greed of prey, the glutinous nets they spin for their victims, and the poison they kill them with, all tend to create a dread and prejudice against spiders that cannot find words too strong to express itself. Murder is the common charge against them. But spiders are not murderers, they are hunters in the strictest sense of the word, for they hunt and kill but to eat—

"Like warlike as the wolf for what we eat
Our valour is, to chase what flies."

With what ingenuity and skill do they spread their nets. How industriously they work; with what assiduous care do they clean their webs; with what unflagging perseverance do they watch for their prey, and when once the game appears, with what energy and boldness do they attack it, however large it may be. If they use the poison nature has given them, it does but deaden the sensation of the victim to the fate that awaits him. A clever writer has compared mankind to spiders, and it must be confessed that in their hunting proclivities the comparison is uncomfortably close, and he concludes with the idea that if the spider is somewhat wanting in sentiment and amiability, at any rate it has neither "pride nor avarice," which are the marked attributes of mankind.

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Gosse, the naturalist, gives an amusing incident that occurred to him. He was one day riding in an omnibus, in the corner of which sat a butcher, "A man got in whose blue gingham coat also indicated the same trade. They were soon in conversation. 'Do you know Jackson'? asked A. 'No' replied B. 'Where does he slaughter'? This reply, says Gosse, gave me a new idea. These men evidently considered slaughtering as the only occupation worthy of man's thought. Spiders are just the same. If an *Epeira* were to meet a *Clubiona* probably the first interchange of civilities would be, Where do you slaughter?" This again is unfair to the spiders since they slaughter only for their own repast. Nor is it exact, for spiders are not given to gossip. The *Epeira* would have eyed the *Clubiona* with warlike propensities, and had either killed the other, she would have eaten her up forthwith without hesitation, for spiders are true cannibals. There is no want of energy or strength of will in the spider character. Most characteristically does the family bear the name of the unfortunate Arachne. Skilful in spinning, and confident in their work, they have the courage that would have challenged Minerva herself. And now as if overcome in the trial as she was, they show still the same strong feeling of Misarachnos malice that led Arachne in despair to drown herself. I must, however, just mention in conclusion that there is one exception to this general want of amiability and only one British species, so far as I know—the Grass Spiders. They pair, spread their geometric nets, hunt in concert, and live in such steady, domestic harmony and peace as to form a bright contrast to the general habits of the family, and deserve the observations of any one who will attend to them.

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TABLE I.

HEREFORDSHIRE RAINFALL.

1874.	Longtown.	Lynhales, Near Kington.	Rocklands, Near Hereford.	Leysters, Near Tenbury.	Staunton-on-Wye.	Bryngwyn, Near Hereford.	West Malvern.	Wigmore.	Whitfield.	The Graig, Archenfield, Ross.	Stretton Sugwas.	Bromyard Vicarage.	Stoke Bliss.	Leominster, West Lodge.	Careswall, Much Marcle.	Richmond Place, Hereford.	Hampton Court, Near Leominster.	Fownhope Vicarage.	Hagley Park, Near Hereford.	Tupsley, Near Hereford.	Ledbury, West Bank.	Hephill, Lugwardine.
	8 in.	2 ft.	1 ft. 10in.	6 in.	1 ft. 1 in.	10in.	1 ft. 6 in.	10in.	6 in.	1 t.	1 ft.	8 in.	1 ft. 2 in.	1 ft.	3 ft.	5 ft. 8 in.	1 ft. 4 in.	1 ft.	6 in.	1 ft. 1 in.	6 in.	8 in.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
January	4.44	3.16	4.01	2.78	2.46	3.46	2.72	2.78	3.25	3.21	2.80	2.27	2.22	2.03	2.92	2.59	2.59	2.81	2.65	2.50	2.38	2.79
February	3.85	3.30	3.43	4.08	3.21	2.96	2.98	2.60	3.08	2.88	2.53	2.76	2.82	2.96	2.99	2.61	2.60	2.59	2.41	1.57	2.68	2.40
March	1.37	1.26	0.97	1.06	0.98	0.93	0.68	0.96	0.84	0.89	0.78	1.03	0.92	0.84	0.81	0.79	0.97	0.61	0.88	1.25	0.88	0.74
April	2.56	1.50	1.92	1.82	1.59	2.06	2.18	1.01	1.69	1.66	1.54	1.75	1.49	1.08	1.63	1.72	1.38	1.71	1.84	1.77	1.66	1.72
May	1.00	1.46	1.05	1.42	1.20	0.79	1.52	1.13	0.95	0.63	1.41	1.64	1.49	0.98	0.76	1.06	1.03	0.96	1.19	1.15	0.96	1.07
June	1.10	1.05	1.50	1.16	0.98	0.69	1.11	0.67	0.59	1.30	1.02	0.85	0.85	0.66	1.04	0.69	0.80	0.67	0.78	0.65	1.20	0.81
July	0.89	1.50	1.11	1.07	1.43	0.83	1.82	1.15	0.87	1.47	0.85	0.87	1.33	0.92	0.84	0.88	0.61	0.72	0.95	0.95	0.77	0.91
August	3.32	4.62	2.93	3.61	3.01	2.77	2.26	2.84	2.68	2.17	2.49	2.62	3.24	2.89	2.40	2.18	2.93	2.50	1.61	1.43	2.16	1.63
September	5.26	3.02	4.70	4.54	4.64	4.76	3.75	4.30	4.70	4.29	4.09	4.12	3.72	3.97	4.05	4.32	4.60	4.16	4.04	3.25	3.33	3.70
October	4.76	4.69	3.26	2.47	3.65	2.91	3.06	3.23	3.10	2.32	2.93	2.54	2.15	3.55	2.06	2.72	2.38	2.13	2.97	3.57	1.51	2.41
November	3.45	2.63	2.41	2.93	2.80	2.38	2.70	2.83	2.36	2.20	2.69	2.82	2.79	2.47	2.70	2.36	2.29	2.37	2.41	1.36	2.62	1.94
December	3.71	3.19	2.99	1.19	2.55	2.51	2.00	2.94	2.28	2.96	2.67	2.49	2.63	2.50	2.59	2.49	1.88	2.61	2.11	3.39	2.20	1.51
Totals	35.71	31.38	30.28	30.13 A	28.50	27.05	26.78	26.44	26.39	25.98	25.80	25.76	25.65 B	24.85	24.79	24.41 C	24.06 D	23.84	23.84	22.84	22.35	21.63

NOTE.—The measurements in feet and inches given under the names of places denote the height, in each case, of the rim of the rain-gauge above the ground.

A. 30.56 according to "Symond's Rainfall."—B. 25.70 according to "Symond's Rainfall."—C. 24.420, when the figures in the third place of decimals are taken in. In "Symond's Rainfall" it is printed 24.36.—D. 24.07 according to "Symond's Rainfall."

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NOTES TO TABLE I. 1874.

The Latitude and Longitude of Hereford Cathedral are as follows:—

Latitude 52° „ 3′ „ 13.9″ N.

Longitude 2° „ 42′ „ 53″.5 W.

The height of the Cathedral yard above sea level is 184.38 feet. This altitude was ascertained by connecting the railway levels with the Ordnance bench-marks at Hay and following the railway levellings, by means of the working section, all the way to Hereford. For this service we are indebted to Mr. Roberts, C.E., of Brecon. The altitude thus obtained agrees closely with that found by barometrical measurement.

1. Longtown is 13 miles and 3 furlongs S.W. of Hereford. The altitude of the gauge at this station has not yet been determined, but Pandy Railway Station is 348 feet above the sea, and Longtown is certainly higher than Pandy.

2. Lynhales is 14 miles and 4 furlongs N.W. of Hereford, but the altitude of the rain guage station has not yet been determined. Lyonshall (or Lynhales) at the "Turnpike by Old Tramway Crossing" is, according to Mr. Roberts, 566 feet above sea level.

3. Rocklands is 14 miles S.S.E. of Hereford. The rim of the gauge at this station is 97 feet 7 inches above sea level. This altitude was ascertained by following the railway levels from the Ordance bench-marks at Hay to the platform of the Kern Bridge Station, and levelling from thence to the gauge by aneroid.

4. Leysters, at Leysters Pole, is 15 miles and 1 furlong N.N.E. of Hereford. The road at this point is 702 feet above sea level. (Ordnance Survey.)

5. Staunton-on-Wye is 8 miles and 6½ furlongs N.W. of Hereford, and the height of the gauge above sea level is stated to be 255 feet. This altitude was obtained, I believe, by levelling by aneroid from the nearest bench-mark or railway station.

6. Bryngwyn is 6 miles and 2 furlongs S. by W. of Hereford and, according to two barometrical measurements, 415 feet above sea level.

7. West Malvern is 16 miles and 2 furlongs E. by N. of Hereford, and according to the Observer, Mr. Hartland, 850 feet above the sea. West Malvern however really belongs to Worcestershire. (Altitude ascertained by barometer and boiling water.)

8. Wigmore is 19 miles and 2 furlongs N.W. by N. of Hereford. I know nothing about the altitude of this station, but Ordnance bench-marks will be found at the neighbouring village of Walford, a distance of 2½ miles in a straight line. The ground at the cross-roads in Walford village is 398 feet above the sea, and the Ordnance mark on the East battlement of Leintwardine Bridge 395.5 feet. —See Woolhope Transactions for 1872, p.p. 56, 57.

9. Whitfield is 6 miles and 2 furlongs S.W. of Hereford and, by barometer, (one measurement only) 427.78 feet above sea level. The rails at St. Devereux Station are 282 feet above the sea. It will be well to try the difference of altitude between the Whitfield guage and the rails at this station.

10. The Graig, Ross, is 11 miles and 2 furlongs S.E. by S. of Hereford and, by barometrical observation, 200 feet above sea level.

11. Stretton Sugwas is 3 miles and 1 furlong W.N.W. of Hereford, and at least 200 feet above sea-level, *i.e.*, at the Vicarage. The rails at Credenhill are 251 feet above sea level and this station is about 1 mile and 3 furlongs from the

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Stretton rain guage; there will therefore be no difficutly in finding the exact altitude of this rainfall station.

12. Bromyard is 12 miles and 7½ furlongs N.E. of Hereford, and, from Observation by aneroid, the observer (the Rev. Nash Stevenson) believes the altitude to be 380 feet. The rails at Leominster are 230.97 feet above sea level, and if the Railway Engineers will kindly tell us the difference between this altitude and that of the new Bromyard Station, they will very greatly oblige the Herefordshire rainfall observers, who, at present, have no other means of obtaining this information by spirit levelling.*

13. Stoke Bliss is 16 miles and 4 furlongs N.E. of Hereford, and 400 feet above sea level, according to Barometrical observations made by the observer.

14. Brockhampton is 14 miles and 5 furlongs N.E. by N. of Hereford. Altitude not yet ascertained.

15. Leominster, West Lodge, is 11 miles and 7 furlongs nearly due N. of Hereford, and at the junction of Dishley Street and West Street, 262 feet above sea level. (Ordnance.)

16. Careswall, Much Marcle, is 9 miles E.S.E. of Hereford and, by barometrical measurement 423 feet above sea level. I have made one measurement only of this altitude.

17. Hereford. The Latitude and Longitude of Hereford are given above, as well as the altitude. There are two gauges, viz., one near the White Cross, kept by Mr. Davison, and one in my garden at 3, Richmond Place. The rim of the White Cross gauge is 202.61 feet above sea level and that of the Richmond Place gauge 178 feet.

18. Hampton Court is 7 miles and 6 furlongs nearly due N. of Hereford; a little to the E. of N., as Leominster is a little to the W. of N.; but the alitude is nowhere given. The true altitude of the Leominster rails being known (230.97 feet) that of Hampton Court can be determined very easily.

19. Fownhope Vicarage is 5 miles and 3½ furlongs S.E. of Hereford, and 192 feet above the sea, (barometrical measurement).

20. Hagley Park is 3 miles E. by N. of Hereford and 301 feet above the sea, (barometrical measurement.

21. Sellack Vicarage is 8 miles and 4 furlongs S.S.E. of Hereford and, to the best of my belief, from observations made in the years 1869 and 70, 240 feet above the sea.

22. Tupsley is 1¼ miles E. of Hereford and 233 feet above the sea, (barometrical measurement).

23. West Bank (Ledbury) is 12 miles and 5 furlongs E. by S. of Hereford, and is estimated (on very good grounds) to be 410 feet above sea level.

24. Hephill (Lugwardine). I cannot find Hephill marked in the Ordnance Map but the distance and bearing from Hereford must be nearly the same as the distance and bearing of Hagley Park. The altitude also probably differs but little from that of Hagley Park.*

N.B.—All the above measurements of distances from Hereford have been made on the Ordnance Map in perfectly straight lines.

EDWIN J. ISBELL.

*According to recent measurements, made by means of standing barometers of the best construction, the Gate-house at Hephill appears to be 300 feet above the sea, and the gravel in front of Hagley Park House 301 feet. Also, since these notes to Table I. were written. correct information respecting the altitude of the rails at Bromyard has been furnished by the Rev. Nash Stevenson, who received the same from the Engineers of the Worcester and Bromyard Railway. The rails at the new Station are, it appears, 441 feet above sea level.

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TABLE II.

A Table shewing Monthly and Yearly Totals of rainfall measurements in Herefordshire during the last 57 years.

	Years.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Totals.
		In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Pool Cottage.	1818	2.20	1.62	1.52	5.81	2.34	1.43	1.22	0.50	2.94	2.67	4.20	0.82	27.27
	1819	3.64	3.66	1.05	2.30	3.63	2.51	1.54	0.88	2.04	1.63	1.65	2.25	26.78
	1820	2.67	1.37	0.57	1.22	2.78	1.01	2.35	1.76	1.15	4.38	1.50	1.67	22.43
	1821	2.23	0.42	3.66	2.81	1.32	1.55	3.67	2.75	4.38	2.53	3.85	6.04	35.21
	1822	0.72	2.29	1.37	2.97	1.55	0.40	5.04	1.72	1.39	5.71	5.38	1.72	30.26
	1823	3.74	2.97	0.91	2.36	2.21	1.47	4.33	3.08	1.18	5.07	2.11	4.42	33.85
	1824	0.45	2.95	2.19	1.55	1.28	3.31	1.33	1.98	3.48	5.57	3.66	4.61	31.76
	1825	0.94	0.92	1.94	2.02	2.13	1.31	0.38	3.25	1.96	2.86	3.12	3.73	24.56
	1826	1.97	4.34	1.94	1.04	1.38	0.03	1.44	1.34	4.72	1.99	1.54	3.60	25.33
	1827	1.43	0.76	3.58	0.60	2.40	0.78	1.73	1.49	3.17	3.18	2.56	5.28	26.96
	1828	4.86	2.14	0.92	4.23	4.16	1.59	4.85	3.26	3.32	2.50	1.92	4.30	38.05
	1829	0.74	1.53	1.31	4.81	0 33	3.82	5.42	4.19	4.20	1.10	0.63	0.66	28.74
	1830	1.36	1.48	0.63	3.70	2.98	4.68	2.84	2.91	3.41	0.53	5.03	3.32	32.87
	1831	3.06	2.43	2 75	2.83	1.65	1.50	3.30	1.14	3.31	5.45	1.68	5.18	34.28
	1832	1.12	1.06	1.88	1.22	2.37	3.60	1.03	4.41	0.75	3.56	3.97	1.87	26.84
	1833	0.67	6.86	1.55	2.46	0.80	3.59	1.49	0·71	1.87	3.44	2.24	2.95	28.63
	1834	5.33	1.05	0.54	1.61	1.35	1.91	7.49	3.19	2.06	1.24	2.16	1.16	29.09
	1835	1.18	3.17	2.64	1.00	3.04	2 74	2.01	2.02	4.22	4.79	4.80	0.52	32.13
	1836	1.92	1.34	4.65	2.70	0.41	1.47	2.71	1.93	2.31	3.63	4.41	3.11	30.59
	1837	3.33	3.74	1.37	1.58	1.14	2.17	2.32	4.67	1.99	2.64	2.09	3.10	30.14
	1838	2.45	3.40	1.48	1.88	3.84	5.59	1.48	2.16	1.80	2.39	6.81	2.36	35.64
	1839	1.28	1.35	2.09	2.08	0.97	5 56	5.92	2.66	5.57	4.12	5.88	3.15	40.63
	1840	3.55	2.81	0.05	0.53	2.15	2 07	1.17	1.47	2.22	2.11	6.24	0.33	24.70
	1841	3.72	2 87	2.98	1.87	3.53	2.53	1 99	3.70	5.80	3.35	4.45	2.99	39.78
	1842	2.94	1.87	2.70	0.21	2.45	2.29	2.36	1.99	3.56	1.06	7.38	1.11	29.92
Burcher Court, Titley.	1841	0.56	1.10	2.42	3.00	0.92	2.30	2.05	5.64	5.13	3.65	4.91	3.33	35.10
	1842	1.77	1.38	3.95	0.32	2.72	5.15	2.47	0.90	2.80	1.18	6.37	4.37	33.38
	1843	3.24	2.78	1.55	3.52	4.33	3.78	2.29	2.18	0.56	6.28	3.71	1.25	35.47
	1844	1.56	2.97	4.02	0.43	0.18	0.83	2.30	2.44	2.11	2.55	3.23	0.97	23.59
	1845	2.71	0.96	1.27	1.80	1.40	2.43	3.50	3.55	3.02	1.80	3.15	4.10	29.69
	1846	3.12	1.41	2.25	3.67	2.08	3.01	2.80	3 40	1.52	4.89	2.08	0.54	30.77
	1847	3.01	1.25	1.97	1.79	3.05	1.48	1.57	1.37	2.20	4.65	1.73	5.92	29.99
	1848	0.54	4.23	3.15	3.24	0.77	5.18	2.65	5.46	2.39	5.09	1.34	3.81	37.85
	1849	3.10	1.28	1.09	3.57	2.59	0.72	1.97	1.23	3.67	3.78	2.10	3.28	28.38
	1850	1.78	2.07	0.82	4.19	1.70	0.85	1.58	1.74	0.65	1.95	3.14	2.23	22.70
	1851	5.22	0.44	4.15	1.58	1.14	1·37	3.57	1.68	0.75	2.03	0.55	2.10	24.58
	1852	5.57	2.70	0.40	0.60	1.83	4.88	2.26	5.66	2.49	3.18	9.52	4.44	43.53
Rocklands.	1852	...	...	...	0.38	1.89	5.37	2.87	4.78	3.00	4.04	9.48	4.46	36.27
	1853	3.81	0.86	0.89	1.80	3.08	3.55	4.68	2.55	2.07	3.90	2.05	0.95	30.19
	1854	2.87	0.89	0.68	0.34	2.48	1.96	3.54	0.67	1.23	2.40	1.66	0.70	19.42
	1855	0.29	1.22	1.79	0.60	3.41	2.68	3.93	1.60	2.41	4.42	0.70	2.07	25.12
	1856	3.18	2.78	1.60	3.06	2.95	1.24	1.32	5.57	3.19	2.64	0.70	4.33	32.56
	1857	2.12	1.40	2.32	2·49	1.66	1.46	2.22	3.23	2.27	3.94	2.35	0.72	26.18
	1858	0.44	1.27	0.87	4.72	2.32	0.99	1.50	2.47	1.97	4.03	1.02	2.44	24.04
	1859	1.46	1.65	2.85	3.21	1.37	2 26	1.92	3.40	3.91	2.86	4.32	4.32	33.53
	1860	4.75	0.66	3.02	1.37	3.27	7.12	1.70	4.95	2.85	2.17	3.52	5.39	40.77
	1861	0.81	4.46	2.73	0.60	1.39	2.48	6.56	0.65	2.51	2.41	3.72	3.53	31.85
	1862	3.00	0.96	4.98	2.73	3.94	3.81	2.19	1.72	4.37	4.39	0.93	2.25	35.27
	1863	4.82	0.94	1.27	1.80	0.75	4.27	0.71	2.87	4.13	4.00	2.38	1.38	29.32
	1864	1.47	1.34	3.29	0.88	0.84	1.51	0.84	0.82	2.91	2.38	3.95	2.05	22.28
	1865	3.75	2.07	0.88	0.51	2.42	1.60	3.15	4.01	0.06	5.52	4.38	4.09	32.44
	1866	5.64	3.23	3.03	2.26	0.96	2.39	1.54	3.28	8.50	2.56	1.95	1.83	37.17
	1867	5.15	2.52	4.77	2.93	3.34	1.09	2.75	1.80	1.73	3.52	1.18	0.77	31.55
	1868	4.92	1.91	2.42	2.74	1 39	0.33	0.42	5.52	4.86	2.06	3.05	7.51	37.13
	1869	9.04	3.65	2.20	1.00	3·93	1.00	0.41	1.07	5.75	1.89	1.71	6.48	38.13
	1870	3.17	3.47	1.57	0.42	1.66	0.44	1.38	1.47	1.67	4.71	4.15	2.09	26.20
	1871	2.69	2.33	1.96	3.23	0.86	2.01	4.17	2.38	7.06	2.83	0.74	3.21	33.47
	1872	5.65	4.95	2.87	2.81	1.76	3.26	6.69	2.36	2.30	4.21	6.81	5.01	48.68
	1873	6.11	1.18	4.30	0.90	2.12	3.12	2.74	4.21	1.70	2.36	2.58	0.77	32.09
	1874	4.01	3.43	0.97	1.92	1.05	1.50	1.11	2.93	4.70	3.26	2.41	2.99	30.28

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REMARKS ON TABLE II. 1874.

This table gives at a glance a perfect view of rainfall experienced in the County of Hereford during the last 57 years.

The stations are :—1st, Pool Cottage, situated on the shoulder of Aconbury Hill; 2nd, Burcher Court, near Titley; 3rd, Rocklands, 4 miles W.S.W. of Ross.

1st, Pool Cottage is 4 miles and 6 furlongs S. by W. of Hereford, and, by barometrical measurement, 485 feet abovesea level.

The mean of the rainfall totals for 25 years is 30.65 inches.

The dryest year (1820) gave a total of 22.43 inches, and the wettest year (1839) a total of 40.63 inches.

The observer was the late Captain Pendergrass, who appears to have been the leader of Meteorological observers in this county.

2nd, Burcher Court, near Titley, is 16 miles 7 furlongs N.W. of Hereford, and (by *Ordnance, Railway,* and *Aneroid* levelling combined) 597 feet above sea level.

The mean of the rainfall totals for 12 years is 31.24 inches.

The dryest year (1850) gave a total of 22.70 inches, and the wettest year (1852) a total of 43.53 inches.

The observer was the late R. B. Boddington, Esq., a most careful and trustworthy recorder of meteorological phenomena.

We have in the Burcher Court series a record of the rainfall of 1852, next to 1872 the wettest year recorded by Herefordshire observers; indeed that year is the last on the list of Mr. Boddington's printed rainfall report. This printed report contains the monthly and yearly totals of 12 years only, but after Mr. Boddington's death the rainfall obsetvations were continued at Burcher Cottage, a residence very near Burcher Court but about 40 feet lower, and the yearly totals will be found at p. 50 in the Woolhope Transactions for 1872, with the exception of 1864, 1865 and 1867.

The mean of the rainfall totals for 30 years is 31.66 inches.

3rd, Rocklands is 14 miles S.S.E. of Hereford, and (by *Railway, Barometrical,* and *Aneroid* levelling combined) 97 feet 7 inches above sea level.

The observer J. M. Herbert, Esq., commenced this valuable series of observations, in 1852 so that it dates its beginning from April 1st in that remarkable year.

The mean of the rainfall totals for 22 years is 31.72 inches.

The dryest year (1870) gave a total of 26.20 inches, and the wettest year (1872) a total of 48.68 inches.

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In 1872 the total at Titley was 49.54 inches. Hitherto Rocklands, Titley and Pool Cottage stations, alone of all Herefordshire stations, have yielded means of 30 inches or more. Doubtless Longtown will now take the lead, unless a fresh observer in a wetter locality shall enter the lists. Lynhales will also, I doubt not, always stand in the foremost rank as it has very high land to the West and North West. Leysters too, the highest rainfall station in the county, will probably take a place among the stations having 30 inches or more of mean rainfall.

With respect to the three stations, the immediate subjects of the present remarks,—

1st. The neighbourhood of Pool Cottage doubtless owes its comparatively large amount of rainfall to its elevation and the influence of the high land and extensive wood of Acornbury. This hill is at least 916 feet above sea level, and its summit is not a mere peak but two ridges, each a mile in length at least, one facing N.N.E. and the other W. by N., very nearly, and meeting to the N.E. The wooded land too is very extensive.

2nd. Titley of course feels in a still greater degree the effects of the more lofty Radnorshire mountains, and the altitude of the Titley gauge was more than 100 feet greater than the gauges at Pool Cottage.

3rd. Rocklands is low, but it is surrounded by the high lands and woods of the Forest of Dean; it is situated in a river valley; and it is within 11 miles of the estuary of the Severn. All these causes combine to increase the amount of rainfall in this neighbourhood, so that the mean of all the yearly totals at Rocklands, only 97 feet above sea level, is found to be somewhat greater than the mean of the Titley yearly totals at an altitude of 600 feet.

EDWIN J. ISBELL,

September 3rd, 1875.

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ALTITUDES SENT BY MR. ROBERTS, C.E.

	Height above sea-level in feet.
Hereford, Barr's Court Station	174
,, Barton ditto	176
Holm Lacy ditto	201
Fawley ditto	198
Ross ditto	128
Mitcheldean ditto	348
Longhope ditto	222
Grange Court ditto	55
Level of rails at Hay	254
Whitney Station	259
Eardisley ditto	230
Moorhampton ditto	337
Credenhill ditto	251
Moorfield ditto	179
Rails on bridge over Canal at Widemarsh	184
Tram Inn Station	288
St. Devereux ditto	281
Pontrilas ditto	265
Pandy ditto	345
Llanvihangel ditto	472
Abergavenny ditto	236
Rhayader ditto	712
Dolau Chapel, near Nantmel	703
Nantmel School	687
Llanbadarn-fawr Church	622
Llandegle Church	809
Summit on Road from New Radnor to Builth	1242
Ditto ditto ditto to Penybont	1275
"Castle Trot" Tumulus	1273
Forest Gate House	1146
Leynhilyn Pool	1212
Llanvihangel Nantmelan Church	987
New Radnor, Base of Sir Geo. Cornewall Lewis's Monument	752
Kington Station platform	492
Lyonshall, on Turnpike by Old Tramway Crossing	566
Titley Station platform	489
Presteign, on sill of entrance to County Gaol	500.4
Kinsham, on road north side of bridge over River Lugg	413
Lingen Village	476
Berkeley Cross Turnpike Gate	567
Leintwardine Village, near the bridge	397
Hopton's Heath Station platform	469

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ALTITUDES SENT BY MR. ROBERTS, C.E.—*Continued.*

	Height above sea-level in feet.
Clunton Village	515
Clun, near Hospital	583
Broom Station platform	454
Craven Arms Station platform	398
Pembridge Station	322

For all these altitudes we are indebted to Mr. Roberts, C.E.: They were determined by connecting the Railway levellings at Hay with the Ordnance bench marks found at that place, as already stated in notes to Table I. It will be seen above that Mr. Roberts gives 174 feet as the altitude of Barr's Court Station, and the accuracy of his statement is proved in the most satisfactory manner by following the railway levellings to the Ordnance bench marks at Leominster, thus:—The bench mark on the front of Leominster Town Hall is 250·478 feet above sea-level, and 19·5 feet above the rails at the Leominster Station. The rails at Leominster Station are therefore 230·987 feet above the sea; and, by Railway levelling, they are 57 feet above the rails at Barr's Court, Hereford. Therefore the rails at Barr's Court are 173·978 feet above the sea.

EDWIN J. ISBELL.

METEOROLOGICAL NOTES AND OBSERVATIONS FOR THE YEAR 1874.

Instead of drawing up the usual tables of barometrical readings, temperatures, and daily direction of the wind, I have this year reproduced the monthly meteorological notes already given to the public in the pages of the *Hereford Times*. In these notes the reader will find all he could have found in the tables, and, in addition, some facts and remarks which would not have appeared in them. A few corrections and necessary alterations have been made, but the notes are substantially the same.

The mean of all the 9 a.m. barometrical readings during the year 1874 is 29·767 inches, the readings being corrected for temperature and error, but not reduced to sea-level.

The cistern of my own standard barometer being 187 feet above sea-level we may add 0.20 inch to bring the above mean to sea-level reading, and then we shall come very close to the yearly mean of the barometer at sea-level on the British coasts, viz., 29·95 inches.

The most remarkable atmospheric pressure during the year occurred on the 6th of March, when the barometer, corrected but not reduced to sea-level, read 30·621 inches at 9 a.m.

The lowest 9 a.m. reading during the year (28·433 inches) was registered on November 29th.

The mean temperature of the whole year was above the average, being 49·59 degrees, while Mr. Glaisher's average year shows a temperature of 49·02 degrees. I will here place in parallel columns the mean temperatures, 1st of the months in

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that wonderfully hot year 1868, 2nd of the months of the past year, and 3rd of the months of Mr. Glaisher's average year :—

	1868. Degrees.	1874. Degrees.	Mr. Glaisher's Average Year. Degrees.
January	38·82	41·86	36·9
February	44·10	39·12	38·7
March	44·00	44·82	41·7
April	47·75	50·59	46·2
May	56·90	51·48	52·9
June	60·84	58·65	59·1
July	65·97	64·82	61·8
August	61·29	60·74	61·2
September	57·94	56·70	56·6
October	46·82	51·01	50·2
November	41·24	42·10	43·2
December	46·14	33·20	39·8
	50·98	49·59	49·02

In 1868 the hottest day at Hereford was July 22nd, when the thermometer in shade, at 4 feet from the ground, stood at 96·1 degrees.

In 1874, the hottest day was July 19th, when the thermometer in shade, at 4 feet from the ground, stood at 94·2 degs. But on no other day in this year did the mercury reach 90 degs., while in 1868 it exceeded 90 degs. on four days in July, and four in August. In fact, the only remarkable high temperature this year occurred in April, from the 20th to the 30th, and in July, from the 2nd to the 20th.

December was a very cold month, the thermometer in shade, at 4 feet from the ground, sinking to 5·3 degs. at Hereford, and lower still in more exposed situations. But this severe cold did not last, for January of the present year had a mean temperature much above the average.

The rainfall total for the whole year is below the average quantity. We usually adopt the mean of the late Mr. Lawson's rainfall measurements as the mean average for Hereford. He observed for 16 years, but we have the records for 15 years only, the record for 1834 being lost. The mean calculated from these records is 27·48 inches.

The difficulty, however, of establishing the mean yearly rainfall for any place is well known, and therefore, when I say that the mean yearly total is below the average, I wish to be understood as speaking of the mean of the late Mr. Lawson's yearly totals. The mean of my records during the last seven years is 28·68 inches, although the rim of my guage stands five feet eight inches above the ground. It is true these seven years include the wettest year recorded in Herefordshire rainfall, but then it is equally certain that they include the dryest year also. The Whitecross rain-guage, kept by Mr. Davison, gives a mean of 29·82 inches for the last six years ; and these six years also include the wettest and dryest year recorded by Herefordshire observers, viz., 1872 the wettest, and 1870 the dryest since the late Captain Pendergrass commenced his rainfall observations in the year 1818. The rim of Whitecross guage stands one foot from the ground.

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I found 0·01 inch or more of rainfall in my guage on 190 days during 1874. I say *rainfall*, but in many cases there was no rain, properly speaking, the deposit being caused by condensation of fog or dew. Snow is simply frozen rain, but I allude to fog and dew in order to show the necessity of examining the bottle of the rain-guage every morning without fail, even in the dryest weather. A deposit of 0·01 inch from dew will be frequently found when least suspected, and this should be always recorded. In fact, unless observers examine their guages every day, they should not make a return of wet and dry days (so called), because their figures will in the end lead to wrong conclusions.

The following figures will enable the reader to compare the rainfall of the past year with the dryest year and the wettest year since rainfall observations were commenced in this county :—

RAINFALL, MEASURED BY RICHMOND-PLACE GUAGE; RIM, 5FT. 8IN. ABOVE GROUND, AND 188FT. ABOVE SEA LEVEL.

	1870. Inches.	1872. Inches.	1874. Inches.
January ...	1·964	4·663	2·587
February ...	1·966	3·371	2·615
March ...	1·408	1·781	0·787
April ...	0·642	2·723	1·721
May ...	1·020	1·377	1·057
June ...	0·220	3·571	0·693
July ...	1·194	5·839	0·884
August ...	1·048	2·202	2·184
September ...	1·464	2·127	4·317
October ...	3·881	4·091	2·719
November ...	2·398	5·567	2·362
December ...	1·426	4·947	2·494
	18·631	42·259	24·420

MONTHLY METEOROLOGICAL NOTES FOR 1874.

JANUARY.

The mean of all the 9 a.m. barometrical readings during the month of January is 29·825 inches.

The highest 9 a.m. reading (30·370 inches) was registered on the 28th, and the lowest (29·032 inches) on the 3rd.

The barometer continued high during the last seven days of January, the 9 a.m. readings ranging from 30·210 to 30·370 inches.

All the barometrical readings given in these notes are corrected for error and capillarity of instrument, but not reduced to sea-level. The height of the barometer-cistern above sea-level is 187 feet.

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The mean temperature of the month was 41·86 degrees, being 4·96 degrees higher than the average temperature assigned to January (from a comparison of fifty years) by Mr. Glaisher.

The highest reading of the thermometer in shade (55·3 degrees) was registered on the 27th, and the lowest readings (25 degrees) on the 6th and 7th.

The mean degree of humidity was 92·9 degrees, complete saturation being 100.

The rainfall total is a fair amount for January—that is, at Hereford—but no remarkable falls have occurred. The greatest fall in 24 hours (0·465 inch) belongs to the 9th. The January total is 2·587 inches.

There was a depossit of water in the rain-guage to the amount of ·01 inch or more on 19 days.

The winds, at 9 a.m. daily, were as follows:—N. 1; N.E. 0; E. 0; S.E. 3; S. 8; S.W. 5; W. 3; N.W. 9; uncertain, 2.

There was a remarkable fog on the 22nd; but the chief meteorological fact to be remembered is the extraordinary mildness of the month. During January we have enjoyed an average March temperature, the average for March being 41·7 degrees.

FEBRUARY.

The mean of all the 9 a.m. barometrical readings during the month is 29·800 inches.

The highest 9 a.m. reading (30·439 inches) was registered on the 4th, and the lowest 28·832 inches) on the 26th.

The mean temperature of the month is 39·12 degrees, Mr. Glaisher's average temperature for February being 38·7 degrees.

The highest reading of the thermometer in shade (54 degrees) was registered on the 14th, and the lowest (21·8 degrees) on the 10th.

The mean degree of humidity is 88.5 degrees, complete saturation being 100.

The rainfall total is 2·615 inches. A large amount of rainfall was measured on the morning of the 27th (0·620 inch).

There was a deposit of water in the rain-guage to the amount of ·01 inch or more on 15 days.

The winds, at 9 a.m. daily, were as follows:—N. 0; N.E. 2; E. 2; S.E. 7; S. 7; S.W. 1; W. 0; N.W. 9.

The points most worthy of notice during this month were the high readings of the barometer from the 1st to the 11th, the very low readings on the 26th and 27th, the gale on the night of 25th—26th, and the heavy fall of rain on the 26th.

MARCH.

The mean of all the 9 a.m. barometrical readings during the month of March is 30·000 inches.

The highest 9 a.m. reading (30·621 inches) was registered on the 6th, and the lowest (29·436 inches) on the 9th.

The barometer stood above 30 inches on 15 days.

The mean temperature of the month was 44·88 degrees, Mr. Glaisher's average for March being 41·7 degrees.

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The highest reading of the thermoneter in shade (69·7) was registered on the 23rd, and the lowest reading (23·5) on the 11th.

The mean degree of humidity was 84·2; complete saturation being 100.

The rainfall is very small, being far below an average fall for March—only 0·787 inch.

There was a deposit of water in the rain-guage to the amount of 0·01 inch or more on 11 days.

The winds at 9.0 a.m. daily were as follows:—N. 1; N.E. 0; E. 2; S.E. 4; S. 4; S.W. 5; W. 7; N.W. 7; calm, 1.

The chief point of interest during this month was the great atmospheric pressure on the 6th. The following readings were registered during the day:—

	Inches.		Inches.
At 4.0 a.m.	30·508	At 11.45 a.m.	30·587
7.45	30·569	12.30 p.m.	30·578
8.45	30·581	4·45 p.m.	30·562
9.0	30·621		

APRIL.

The mean of all the 9.0 a.m. barometrical readings during the month is 29·660 inches.

The highest reading (30·110 inches) was registered on the 29th, and the lowest (29·041 inches) on the 3rd.

The mean temperature of April is 50·59 degrees, Mr. Glaisher's average temperature for this month being 46·2 degrees.

The highest reading of the thermometer in shade (82·1) was registered on the 27th, and the lowest (31·9 degrees) on the 5th.

The mean degree of humidity for April this year is 78·4 degrees; complete saturation being 100.

The rainfall which was almost entirely confined to the first half of the month, amounts to 1·721 inch; the greatest fall in 24 hours (0·385 inch) occurring on the 2nd.

There were 16 days in which 0·01 inch or more fell.

The winds at 9.0 a.m. daily were as follows:—N. 2; N.E. 3; E. 2; S.E. 4; S. 3; S.W. 6; W. 3; N.W. 4; and 3 days uncertain.

There were gales of wind on the nights of 1st—2nd, and 2nd—3rd, the direction being S.W. to N.W., and back to S.W.

The temperature of the last eleven days of April was extraordinary, the maximum readings being as follows:—

	Inches.		Inches.
20th	72·1	26th	80·7
21st	77·9	27th	82·1
22nd	70·1	28th	74·1
23rd	77·4	29th	70·0
24th	66·2	30th	74·1
25th	68·3		

During this period, however, the nights were cold and the frosts on the grass sharp, even when the air was not quite cold enough to lower the thermometers in the stand to 32 degrees.

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MAY.

The mean of all the 9.0 a.m. barometrical readings for May is 29·768 inches.

The highest reading (30·198 inches) was registered on the 13th, and the lowest (29·042 inches) on the 20th.

The mean temperature of May is, this year, 51·48 degrees, Mr. Glaisher's average temperature for this month being 52·9 degrees.

The highest reading of the thermometer in shade (72·4 degrees) was registered on the 27th, and the lowest (29·1 degrees) on the 11th.

The mean degree of humidity for May, this year, is 77·6; complete saturation being 100.

The rainfall amounts to 1·057 inch; the greatest fall in 24 hours (0·530 inch) occurring on the 22nd.

There were 11 days on which 0·01 inch or more fell.

The widds at 9.0 a.m. daily were as follows:—N. 4; N.E. 11; E. 2; S.E. 2; S. 0; S.W. 6; W. 1; N.W. 4; calm, 1.

JUNE.

The mean of all the 9.0 a.m. barometrical readings during the month of June is 29·934 inches.

The highest reading of the barometer during the month (30·393 inches) was registered on the 15th, and the lowest (29·457 inches) on the 27th.

The mean temperature of June was 58·65 degrees, Mr. Glaisher's average temperature for June being 59·1 degrees.

The highest reading of the thermometer in shade (85·2 degrees) was registered on the 9th, and the lowest (37·3 degrees) on the 13th.

The mean degree of humidity was 77·4; complete saturation being 100.

The rainfall amounts to 0·693 inch only; being a very small total for June. There has been almost an entire absence of dew.

There was a deposit of water in the rain-gauge to the amount of 0·01 inch, or more, on 9 days. The largest rainfall measurement was made on the morning of the 25th (0·318 inch).

The winds at 9.0 a.m. daily were as follows:—N. 1; N.E. 11; E. 0; S.E. 3; S. 4; S.W. 4; W. 2; N.W. 0; calm, 5.

JULY.

The mean of all the 9.0 a.m barometrical readings during the month is 29·792 inches.

The highest 9.0 a.m. reading (30·098 inches) was registered on the 6th, and the lowest (29·402 inches) on the 28th.

The mean temperature of the month is 64·82 degrees, Mr. Glaisher's average temperature for July being 61·8 degrees.

The highest temperature in shade (94·2 degrees) occurred on the 19th, and the lowest (42·6 degrees) on the 6th.

The mean degree of humidity was 72·8; complete saturation being 100.

The rainfall total is small, being only 0·884 inch. The greatest fall in 24 hours (0·28 inch) occurred on the 24th.

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There was a deposit of water in the rain-guage to the amount of ·01 inch, or more, on 12 days.

The winds at 9.0 a.m. daily were as follows :—N. 0; N.E. 1; E. 0; S.E. 6; S. 5; S.W. 4; W. 3; N.W. 6; 1 days calm; 2 uncertain.

AUGUST.

The mean of all the 9 a.m barometrical readings during the month of August is 29·739 inches. The highest reading of the barometer at 9 a.m. during the month (30·305 inches) was registered on the 21st, and the lowest (29·212 inches) on the 14th.

The mean temperature of the month is 60·75 degrees, Mr. Glaisher's average mean temperature for August being 61·2 degrees.

The highest reading of the thermoneter in shade (86·4 degrees) was registered on the 20th, and the lowest (43·8 degrees) on the 5th.

The mean degree of humidity for August is 80·8.

The rainfall total at Hereford amounts to 2·184 inches. The greatest fall in 24 hours (0·388 inch) occurred on the 28th. There was a deposit of water in the rain-guage to the amount of 0.01 inch or more on 18 days.

The winds at 9 a.m. daily were as follows—N. 0; N.E. 2; E. 0; S.E. 6; S. 5; S.W. 9; W. 2; N.W. 7.

SEPTEMBER.

The mean of the 9.0 a.m. barometrical readings during the month is 29·694 inches.

The highest reading (30·138 inches) was registered on the 14th, and the lowest (29·275 inches) on the 9th.

The mean temperature of September, this year, is 56·7 degrees, Mr. Glaisher's average for the month being 56·6 degrees.

The highest reading of the thermometer in shade (77·1 degrees) was registered on the 26th, and the lowest (40·4 degrees) on the 14th.

The mean degree of humidity is 84·7; complete saturation being 100.

The rainfall amounted to 4·317 inches, the greatest fall in 24 hours (1·235 inch) occurring on the 30th.

There were 21 days on which 0·01 inch or more fell.

The winds at 9.0. a.m. daily were as follows :—N. 2; N.E. 3; E. 1; S.E. 4; S. 7; S.W. 6; W. 3; N.W. 2.

OCTOBER.

The mean of all the 9 a.m. barometrical readings during the month of October is 29·646 inches.

The highest reading of the barometer during the month (30·115 inches) was registered on the 31st, and the lowest (29·033 inches) on the 2nd.

The mean temperature of October this year is 51·01 degrees, Mr. Glaishers' average temperature for the month being 50·2 degrees.

The highest reading of the thermometer in shade (63·0 degrees) was registered on the 11th, and the lowest (34·2) on the 20th.

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The mean degree of humidity for the month is 87·4, complete saturation being 100.

The rainfall amounts to 2·72 inches. There was a deposit of water in the rain-guage to the amount of 0·01 inch, or more, on 23 days. The largest amount in 25 hours (0·70 inch) fell on the 6th, and there was another large fall of 0·60 inch on the 27th.

The winds at 9 a.m. daily were as follows:—N. 0; N.E. 5; E. 0; S.E. 0; S. 8; S.W. 8; W. 3; N.W. 4; uncertain, 3. Early on the morning of the 21st it began to blow heavily from the west, and the gale increased as daylight came on. The wind continued in the west, and the storm was a widely extended and destructive one. There was a considerable fall of the barometer. At 9 a.m. the mercury stood at 29·329 inches, whilst, on the previous day, at the same hour, it was standing at 30·036 inches—a fall of 0·707 inch. One of the large trees at Moor House, Widemarsh Common, was blown down, and fell N.N.E., being turned in its fall by the tree which stood on its east side. This tree was about 12 feet in circumference near the ground, and 102 feet in height.

NOVEMBER.

The mean of all the 9.0 a.m. barometrical readings during the month of November is 29·721 inches.

The highest reading of the barometer during the month (30·307 inches) was registered on the 8th, and the lowest (28·433 inches) on the 29th.

The mean temperature of November this year, is 42·1 degrees, Mr. Glaisher's average temperature for the month being 43·2 degrees.

The highest reading of the thermometer in shade (58·2 degrees) was registered on the 5th, and the lowest (24·3 degrees) on the 24th.

The mean degree of humidity for the month is 92·2, complete saturation being 100.

The rainfall amounts to 2·362 inches. There was a deposit of water in the rain-guage to the amount of 0·01 inch or more on 22 days. On the 28th there was a fall of 0·81 inch in amount; this was the greatest quantity which fell in 24 hours during November.

The winds at 9.0 a.m. were as follows:—N. 2; N.E. 9; E. 1; S.E. 6; S. 0; S.W. 1; W. 2; N.W. 8; and 1 day uncertain.

The great fall of the barometer on the 28th was followed by a gale of unusual violence; wind S.E. to W.

DECEMBER.

The mean of all the 9.0 a.m. barometrical readings during the month is 29·635 inches.

The highest reading (30·083 inches) was registered on the 18th, and the lowest (28·618 inches) on the 11th.

The mean temperature of December, this year, is 33·2 degrees, Mr. Glaisher's average for the month being 39·8 degrees.

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The highest reading of the thermometer in shade (53·2 degrees) was registered on the 6th, and the lowest (5·3 degrees) on the 31st.

The mean degree of humidity is 92·9, complete saturation being 100.

The rainfall amounted to 2·494 inches, the greatest fall (snow) measuring 0·72 inches. I measured melted snow on the 15th, 27th, 29th, and 30th. The great fall occurred on the 15th, when the depth of undrifted snow was 8 inches. Three perfect cylinders of snow, equal in diameter to the diameter of my rain-gauge (8 inches), were taken from a good situation, and carefully melted. Measured as rainfall, the average quantity was 0·72 inch very nearly. The ordinary rain-gauge was sufficient to measure the other falls.

There were 13 days on which 0·01 inch or more fell.

The winds at 9.0 a.m. daily were as follows:—N. 5; N.E. 3; E. 3; S.E. 2; S. 2; S.W. 2; W. 3; N.W. 4; calm or uncertain, 6.

EDWIN J. ISBELL.

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THE WYE.

Register of Height of River in the Year 1874, taken at Hereford at 9 a.m. The datum point is the summer level of the river.

1874.	No. of days wet or stormy.	No. of days dry.	Height of River above Summer level.	Average height each day.	No. of days of low water.	OBSERVATIONS.	
			Ft. In.	Ft. in.			Ft. In.
January	10	21	137 8	4 5½	0	Height of River on 9th	10 4
February	8	20	42 7	1 6½	0	,, ,, ,, 26th	4 6
March	7	24	57 6	1 10½	0	,, ,, ,, 18th	7 0
April	15	15	59 4	1 11⅜	0	,, ,, ,, 4th	8 6
May	1	30	5 11	0 2⅛	17		
June	8	22	2 7	0 1	26	,, ,, ,, 26th	1 0
July	13	18	2 10	0 1	28	,, ,, ,, 3rd	1 6
						,, ,, ,, 12th	8 0
August	21	10	70 11	2 3½	5	,, ,, ,, 16th	8 0
						,, ,, ,, 17th	8 0
September	11	19	88 4	2 11⅛	0	,, ,, ,, 2nd	7 0
October	18	13	84 4	2 8⅜	0	,, ,, ,, 5th	10 6
November	20	10	97 3	2 2⅝	0	,, ,, ,, 30th	14 0
December	11	20	100 4	3 2¾	0	,, ,, ,, 9th	13 0
Total	143	222	749 7	24 6¾	76		

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LIST OF NEW MEMBERS ELECTED IN 1874.

Carless, Mr. Henry.
Cobbold, Rev. R. H.
Fielder, Trevor, Esq.
Graves, Joseph, Esq.
Lane, Theophilus, Esq.
Phillips, Edward Cambridge, Esq.
Piper, George Henry, Esq.
Powell, Rev. Richard.
Sandford, Dr.
Scobell, Edwin C., Esq.
Severn, John Percy, Esq.

HONORARY MEMBERS, DECEASED OR RETIRED.

Jardine, Sir William, Bart., F.R.S. &c., deceased.
Edmunds, Flavell, Esq., deceased.
Phillips, Professor John, F.R.S., F.G.S., deceased.

ORDINARY MEMBERS.

Capper, Rev., D.
Collins, John Stratford, Esq.
Downing, Mr. J. B., deceased.
Evans, E. Middleton, Esq.
Feilden, Lieut. Colonel, deceased.
Lightbody, R., Esq., deceased.
Thomas, John E., Esq., F.G.S.

OFFICERS FOR THE YEAR 1875.

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Rev. C. J. Robinson, M.A., Norton Canon Vicarage, Weobley.

Vice-Presidents:

B. Haigh Allen, Esq., Clifford Priory, Herefordshire, R.S.O.
Rev. Samuel Clark, M.A., Eaton Bishop Rectory, Hereford.
Rev. E. Du Buisson, M.A., Brienton Court, Hereford.
F. W. Herbert, Esq., Credenhill Park, Hereford.

Central Committee of Management:

Thomas Cam, Esq., Hereford.
Timothy Curley, Esq., C.E., F.G.S., Hereford.
John Lloyd, Esq., Huntington Court, Hereford.
C. G. Martin, Esq., Hereford.
J. Griffith Morris, Esq., Hereford.

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OFFICERS FOR THE YEAR 1875—(CONTINUED.)

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Rev. C. J. ROBINSON, M.A., Norton Canon Vicarage, Weobley.
Rev. Sir G. H. CORNEWALL, Bart., M.A., Moccas Court, Hereford.
Rev. SAMUEL CLARK, M.A., Eaton Bishop, Hereford.
JAMES RANKIN, Esq., Bryngwyn, Hereford.
D. M. M'CULLOUGH, Esq., M.D., Larchfield, Abergavenny.
Rev. H. COOPER KEY, M.A., F.R.A.S., Stretton Rectory, Hereford.

Honorary Secretary :

Rev. Sir G. H. CORNEWALL, Bart., M.A., Moccas Court, Hereford.

Treasurer and Assistant Secretary :

Mr. ARTHUR THOMPSON, 12, St. Nicholas Street, Hereford.

FIELD MEETINGS APPOINTED FOR 1875.

THURSDAY, MAY 20TH.....Caerleon.
TUESDAY, JUNE 15TH.....Symonds Yat and Buckstone, to meet the Cotteswold Naturalists' Field Club.
TUESDAY, JULY 18TH (Ladies' Day).....Skenfrith, Grosmont, and Garway.
MONDAY, AUGUST 19TH.....Brecon.
THURSDAY, OCTOBER 14TH..... ...A Foray amongst the Funguses.

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The Woolhope Naturalists' Field Club.

MEETING AT CAERLEON.

THURSDAY, MAY 20, 1875.

The Field Naturalists have, on the occasion of their first meeting this year, given a very liberal interpretation to their name, and have enlarged the area of their investigations, so as to include not only man, but also his works at all periods of history. Those members who joined in the excursion to Caerleon on Thursday, the 20th instant, are not likely to find fault with this divergence from the original scope of the Club, for it enabled them to make acquaintance with a district teeming with objects of antiquarian interest, and peculiarly rich in poetic and legendary associations. The day was unfortunately showery, and Isca, true to its etymology, gave its visitors a watery reception; but the unfavourable impression which was thus produced was speedily effaced by the warm welcome bestowed upon the Club by John Edward Lee, Esq.—the learned author of *Isca Silurum*, and the hospitable successor of S. Dubritius at the Priory. Under his guidance the contents of the museum were carefully examined by the Club, the members of which were thus prepared to listen with greater attention and appreciation to the subsequent address of their *cicerone*. The museum contains a vast number of Roman remains found either at Caerleon or at Caerwent *(Venta Silurum)*, and in the collection are included a series of monumental and other inscriptions, coins from the time of Otho down to that of Valens, *fibulæ* of curious workmanship, amulets, *antefixa*, enamels, Samian ware of foreign and domestic manufacture, stone coffins, *amphoræ*, flue bricks, tiles, and *tesseræ*, with other objects too numerous to mention. After an hour had been spent very pleasantly in viewing this curious collection (which has been brought together chiefly through the zeal and munificence of Mr. Lee), the Club proceeded to the grounds of Dr. Woollett, which enclose the site of a Roman villa and the scanty remains of a mediœval castle. The lofty mound at the end of Dr. Woollett's garden was ascended, but it was impossible to ascertain whether it had once supported the "gigantic tower" of

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Arthurian days or the more substantial keep which in mediæval times must have been attached to the castle at its base. Suffice it to say that the view from its summit amply rewarded those who showed themselves indifferent to the wetness of the grass, and the exertion of climbing rendered them better able to do justice to the good fare that awaited them at the Priory. "Many have told of the monks of old," but few can have partaken of better cheer than was spread before the Woolhopians within these monastic walls by their hospitable owner. In truth there was nothing in the scene to remind one of the cell or cowl, and the graceful presence of several young ladies rather carried one's thoughts back to those earlier and more romantic days when at Whitsuntide King Arthur

"Held Court at old Caerleon-upon-Usk."

Dinner over, it devolved upon the President (Rev. C. J. Robinson) to convey to Mr. and Miss Lee the very cordial thanks of the Club for the sumptuous entertainment of which they had partaken, and to request Mr. Lee to unfold, as far as possible, the past history of the military capital of Siluria. As Mr. Lee has kindly permitted the Club to print the paper, it will be enough to add that it was listened to throughout with the greatest attention, and that the writer has fixed its salient points upon the minds of his auditors by kindly presenting to each of them a series of appropriate illustrations.

The weather having now become bright and warm an excursion was made to the site of the old amphitheatre, where, beneath the grassy covering, may still be traced the tiers of seats. Nor is it difficult to recall the time when, from some building on the adjacent ground (still known as the Bear House Field), there issued into the arena "the man and beast for deadly contest trained." It may perhaps be doubted whether the gladiatorial combats in which "man was slaughtered by his fellow man" ever took place on this fair scene; but in the museum of Caerleon there is a fragment of a stone slab upon which is sculptured a fight between a mastiff (of the old English breed), and some wild animal—depicting possibly a fierce struggle which the Roman inhabitants of Isca desired to have commemorated.

The fragments of Roman masonry, which yet form part of the city wall, having been duly inspected, the Club divided itself into two sections, of which one ascended the hill, visited Christchurch, and surveyed the Bristol Channel and smoke of Newport, while the other, led by Mr. F. Moggridge and other local guides, made a close examination of certain antiquarian objects within the limits of Caerleon. These consist chiefly of a ruined tower upon the river side, which commanded the bridge of boats; the upper parts of the house now called the Hanbury Arms (wherein, it may be noted, Lord Lytton and Arthur Tennyson have both lodged), and the parish church, in which are imbedded a Norman arch and pillar of rude design, and part of which rests upon foundations of Roman masonry.

The pleasant day came at length to a close, but not before the Woolhope Club had again experienced the hospitality of the modern Silurians, and at the houses of the Vicar and of Dr. Woollett fortified themselves against the fatigues of the homeward journey.

It was announced that the Fungus Foray this year would be on Thursday, the 14th of October.

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Among those present were the following :—Rev. Charles J. Robinson (President), Rev. James Davies, James Rankin, Esq., Rev. H. C. Key, Rev. H. W. Phillott, Colonel Byrde, Rev. C. J. Westropp, Rev. T. E. Grasett, J. T. Owen Fowler, Esq., Rev. J. Crouch, Dr. Taylor, Rev. T. T. Smith, Dr. Chapman, J. Griffith Morris, Esq., J. Greaves, Esq., Theo. Lane, Esq., Mr. James W. Lloyd, George H. Piper, Esq., Stephen Vernon, Esq. (Newport), J. W. Lukis, Esq. (President of the Cardiff Naturalists' Society), Rev. F. C. Stebbing, Mr. Hamilton, J. M. Llewellin, Esq., Miss Lee, Mrs. Moggridge, Miss Llewellin, Miss Edwards, the Mayor of Hereford, W. Adams, Esq., F.G.S., Rev. J. H. Jukes, Mr. A. Thompson, and Rev. J. E. Machen Jones, to whom, as well as to J. E. Lee, Esq., F.G.S., F. Moggridge, Esq., and Dr. Woollett, the thanks of the Club are largely due.

The Assistant Secretary announced that since the annual meeting he had received a small parcel of pamphlets from the University of Christiana, per Mr. Thomas Butler, Assistant Secretary to the British Museum; and the Assistant Secretary was authorised to convey the thanks of the Club to Mr. Butler.

The following gentlemen were unanimously elected annual members of the Club :—The Rev. William Wyatt, Hope-under-Dinmore, Leominster; John Riley, Esq., Putley Court, Ledbury; the Rev. Arthur Young, Pembridge, Herefordshire; Charles Anthony, Jun., Esq., The Elms, Hereford; Lewis Sargeant, Esq., Hereford; the Rev. G. M. Metcalfe, Pipe and Lyde, Hereford; Richard Thomason, Esq., Drybridge House, Hereford.

ADDRESS ON THE HISTORY AND ANTIQUITIES OF CAERLEON, BY J. E. LEE, ESQ., OF TORQUAY.

It is somewhat singular that though there can be no reasonable doubt as to this place having been for centuries a very important station both in and before the Roman times, yet very little is known of it from actual history. And yet it was the capital of the Silures, the tribe of ancient British inhabitants which was the very last to yield to the Roman power, and besides this it acquired its mediæval or rather post-Roman name from having been the almost permanent quarters of the Second Augustan Legion—one of the best known in the Roman army; the name of Caer-leon being evidently a corruption of *Castrum legionis*. How then are we to explain the fact of so little being actually recorded as to Isca Silurum, the name by which it is known in Roman times? Possibly from the fact of the place being so much on the borders of civilisation, that no one of a literary turn liked to spend his leisure time here and record the doings of the so-called barbarians. I know that this will be called a very doubtful explanation, but I can think of no better, and the difficulty is now mentioned as an apology for what I mean to do during the few minutes which are at my disposal, viz., instead of giving you history, which is only ideal or tradition resting on no certain ground, I will simply describe the place as it is believed to have existed in Roman times, and then mention a few of the more interesting antiquities.

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Now, if we imagine,—and this is no ideal picture, but one borne out by history,—that in those days the primæval woods were dense upon the hills and reached down probably to the plains, so that the larger trees dipped their branches into the Usk, we should find it a very different landscape from that of the present day, when the trees are cut down for timber, and the undergrowth for charcoal, and thus the beauty of the country is sadly lessened.

I well remember the lament of the late owner of Llanwerne House, at the enormous change, since he was a boy, in the country between Llanwerne and Chepstow, where the finest timber flourished luxuriantly, and, as he said, the turnpike road led through a bower of trees on either side. Such, in fact, must have been the appearance of the country in Roman times. Dense wood clothed the mountains, and the only cleared places were the plains where tillage could be carried on or where villas had to be built. Such was the country round Isca. What was the city itself? Of its condition in pre-Roman times we have no knowledge.

Sir R. C. Hoare says that Venta Silurum, or Caerwent, was the native capital, and it is very certain that in Roman times Venta Silurum, or Caerwent, was the mercantile city, while Isca Silurum, or Caerleon, was the military capital. The second Augustan Legion came here, it is believed, under Ostorius the latter part of the 1st century, and though by some inscriptions found on the Scotch Roman wall (commonly called the wall of Antoninus) it evidently had at one time been taken to the north, yet it remained here at Isca for its head quarters nearly, but not quite, as long as the Roman power existed in Britain. Under this long occupation it is of course to be expected that the place would be almost entirely Romanised—and such in fact we may venture to say it was. There are few stations in Britain where more Roman inscriptions have been found than here; but still, strange to say, though nearly all of them are of great interest, they do not in many cases give us positive and definite dates. The earliest inscription found here mentions the names of Severus and his sons, A.D. 193 to 197, and the latest that of Gallienus about A.D. 260. The objects in the Museum, which you have just visited, will have shown you how completely the city was Romanised. An invading nation cannot have taken full possession of the capital of a barbarous people, and colonised it for some hundred years, without making it almost a foreign city. You will accordingly find that nearly all the antiquities are Roman. I have lived here—nay in this very house—nearly five and thirty years, and have been constantly on the watch for antiquities of every kind, but the exceptions to those of Roman date hardly amount to a dozen, while every trench cut within the walls, every excavation for the foundations of a house, every railway cutting brings to light some evidence of Roman occupation. I must, however, descend rather more to particulars, but as ours is a Natural History Society, and it is only by a certain stretch of the imagination that man and his works are considered natural objects, I will be as brief as possible.

Like most other Roman stations or towns, Isca Silurum was in the shape of what is called by some people a long square with the corners rounded off. The walls may with some difficulty be traced on the east side; but to the south, and more

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especially to the west, which we can see from this very room, the walls, or rather the lower parts of them, are actually in existence. The Romans generally fashioned their stones into rather short squares, and in many cases they built with these stones three or four tiers, and then placed upon them a layer or sometimes more of flat tiles or bricks, repeating this alternation until the walls had a very peculiar "liny" appearance. Nothing of the kind, however, is to be seen in the walls of this place. One part of them, nearly opposite to the Priory, is still faced with the square stones mentioned above; but from the fact that some years ago I found on the outward face of one of them Roman mortar with pounded brick it seemed to me that this work was not Roman but of mediæval age, rebuilt, in fact, with Roman stones; but when Mr. Albert Way, a most distinguished antiquary, whose loss we have recently had to deplore, came here and examined the walls in question, he considered them to be Roman work; and, as in duty bound, I gave up my opinion to the judgment of so distinguished an antiquary; still it is a curious fact which is worth recording. And this leads me to remark on the Roman custom of mixing pounded brick with their mortar. There can, I believe, be no doubt that the best mortar is made in this manner. Whether the angularity of the brick fragments hold the mortar better together, or whether there is any advantage from the quicker absorption of the moisture by the dry pounded brick, I cannot say; but it is a fact that the best Roman mortar was always made in this way; and yet, if the truth must be told, very little of the mortar found here was thus made. The whole of that in the large villa, formerly in the grounds now belonging to Mr. Woollett, was without pounded brick; and the same may be said of that of the town walls, with the exception of two of the corners. If we have time enough to spare you shall be shown one corner of the ancient walls, where the undoubted remains of Roman masonry, still *in situ*, may be seen, and the stones are united with mortar mixed with brick; but if you walk 20 or 30 yards on either side the brick ceases! and you find it nowhere else in the walls except at the opposite corner. This corner, however, is in the turnpike road, near the upper turnpike, and you have walked over it without being aware of it; but after a very wet day, when the ground has been well washed, you may see the present pavement (which in fact is a portion of the old Roman wall) made of stones joined with mortar of pounded brick and lime.

Let us now mention a very few of the more interesting objects which we have just seen and we will begin with the inscriptions. Almost every one of these, if this were an antiquarian society, would give scope for a long dissertation. I am not, however, going to weary you, but will merely mention two or three, and tell you why I have thus selected them. The first is one of the finest Roman inscriptions in Britain, the chisel marks in the letters are still clearly visible. It records the rebuilding of the barracks of the seventh cohort by the lieutenant of the Emperors Valerian and Gallienus. The chief point of interest in this inscription is that it gives us a new Latin word "centurias" for barracks.* Turn the inscrip-

*Subsequently the Rev. James Davies, of Moor Court, Kington, mentioned that the word was to be found in Cicero de Leg. *Agr.* II. 13, but that the commentators were evidently puzzled with it.

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tion as you may, nothing else will answer; and this interpretation has stood the test even of German criticism, and yet you will find the word with the interpretation of the "quarters" of a century or company in no Latin lexicon or dictionary whatever.

The second is a short inscription and is chiefly remarkable for the rude delineation below it of the eagle and the capricorns, the devices of the second Augustan legion.

The third is a memorial stone erected to a veteran of the second Augustan legion by his wife. Pray remark the curious mode (well known in lapidary inscriptions) of writing a double II for the letter E. Thus in the word or abbreviation LEG, there is first L, then a double I, and then G. This is not ideal, it is a well known fact. You will find it again in the last inscription to be brought before you. And hereby "hangs a tale." It has been repeatedly published but never deciphered till lately, nor was it understood when I first published it in a quarto volume in 1845. At that time not knowing what to make of it I wrote to the late Sir Samuel Meyrick, who it appears was equally puzzled and asked whether it might not be "Bardic!" an idea with which I could not agree, as the lines surrounding the inscription are evidently Roman. It was, therefore, published without explanation. But when writing the "Isca Silurum" in 1862, I corresponded with several other friends about it; and it is most singular that the truth seems almost at the same moment to have flashed on Mr. King at Cambridge, on Mr. C. Roachsmith near Rochester, and on Dr. M'Caul at Toronto. May I therefore ask you to look at it in two positions? The first as it was formerly published makes it unreadable. Now turn it and you will find that it can be nearly if not entirely decyphered, the figure or "siglum" being the mark for "centurion" >, like a V placed sideways; then C.Ivli, and the second line, though the letters are rude, may (if you bear in mind that the II is frequently used for E) be read Caeciniani, so that the whole inscription may be read clearly, looked at in its correct position, as "The century (or company) of Caius Lucius Caecinianus.

We will now mention a few of the more remarkable antiquities which have been found here, without taking them in any very particular order. Every one knows what wainscotting is, but every one knows also that at present it is made of wood. You have, however, seen some specimens in the museum which show that the Romans used ornamented slabs of stone for this purpose. I remember seeing these stone facings in their original position in the villa in Mr. Woollett's grounds. They are by no means common. The pottery found at Isca is very interesting. The red polished Samian ware, covered with figures, reveals a great deal of the social life of the Romans.

Amongst other things (if indeed it can be called social) you will find combats of gladiators armed exactly as mentioned by the ancient authors, you will find combats of wild beasts both amongst themselves and with human victims, and on some of the fragments you will see elegant designs made of leaves and tendrils. In one case you will see a winged figure playing on the double pipe. The coarser vessels were often sepulchral.

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In one case not a hundred yards from this place there was found (what is exceedingly rare) an earthen jar containing burial bones, which had been buried within the limits of the city. This was quite contrary to Roman customs, and indicates a time when the city was besieged by enemies, and when burials could not be conducted according to the usual plan. In one case a very large vessel (21 inches in diameter) had been used for burial, and within it there were found a small patera or kind of saucer and a piece of copper coin which was fixed to the bottom by oxidation. This coin was doubtless to pay the fare over the ferry to the other world; but it is singular that in no other case have we found a coin in a sepulchral vase. Some of the glass cinerary urns which you have seen in the museum contain the original burnt bones, and are in a fine state of preservation. Not so, however, are the remains of what is called "pillar-moulded glass," generally in the form of fragments of bowls. It is singular that soon after the time of the Romans this manufacture was lost, and not very long ago a patent was taken out in England for this very process! I must leave it to the legal gentlemen present to say whether the patent would stand, as these very specimens in our museum would show that the process was in use sixteen hundred years ago.

In an excavation made in the Priory garden some very pretty fragments of pillar-moulded glass were found of a beautiful mottled colour. These are rare. The Romans knew the art of enamelling as is evident from several of the specimens which you have seen in the museum. Amongst the greatest rarities in our museum are the two carved ivories, one representing a tragic mask and the other possibly Pomona placing a basket of fruit on Cupid's head. What they originally formed is uncertain. They may have been part of the ornamentation of a chariot, as you may see the holes by which they were riveted to something behind. Bone pins for fastening up the hair were found in abundance, one of them ornamented with gold. Bone counters for games were also not uncommon, and bone needles of all descriptions. The bronze objects are very varied, fibulæ or studs, earrings, chains, armill or bracelets, and small figures of various sorts, knives, styli for writing on tablets, shears, part of a small balance and a bell, spoons, keys, and last, not least, a Roman foot-rule which is doubled up, but the two sides together measure exactly as they ought to do, 11.604 of our inches.

While speaking of Roman bronze objects, and more especially shears, some astonishment has been expressed at bronze being used as a cutting material, but it may not be generally known that it is very easy to harden bronze; a very small percentage of iron will have this effect. It is even said that bronze melted in a crucible previously used for melting iron will become exceedingly hard. Some years ago a brass founder in London took out a patent for hardening brass so that it would not wear, adopting this very plan, and he meant to use it especially for the brass of quadrants and sextants, but his scheme fell to the ground, as he found the brass so hard that he could not engrave upon it.

Of coins a large number have been found here. I will mention one fact which will show this. Occasionally when labour was scarce at Caerleon I have set two or three men to work merely to dig a trench in the Priory garden, and in every instance was well rewarded by coins and other remains. The last trench dug here produced half a dozen coins of Carausius, and a couple of Allectus.

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These details will have tired you. May I venture, in conclusion, to bring before your "mind's eye," if I may use the expression, one or two scenes of the olden day. But first, just consider how long it really is since these Roman times. I have lived in this house about 35 years. Now as the Romans were here 1,600 years ago, it would require a succession of fifty men as old as I am to have lived one after the other, to reach up to the olden time we are speaking of. And when you have in imagination thrown yourselves back sixteen centuries, just think of the difference—the city population crowded together in houses within the walls, only the temples and the governor's house with space around them; while between the walls and houses a broad and open street ran round the city. This can be proved. Can you not imagine in peaceful times the citizens walking round the walls, from which the view of a Roman villa here and there in the neighbourhood broke the monotony of the dense wood on the hills? And, if you like to carry your imagination still further, fancy for one moment the excitement attending the arrival of the vessel from Abone (now Sea-mills-on-the-Avon), bringing supplies for the garrison from that more settled province! Can you not imagine that you see the vessel gliding slowly with the rising tide, just kept in mid-stream by an occasional dip of the single bank of oars?

All this you will say is fancy. I will conclude with giving you another scene, which is not fancy. The Romans were great brick and tile-makers. Now, at Venta Silurum, or Caerwent, there was a great tile-yard; and "once on a time," as the novelists say, the military overlooker walked out to see how "the work went on." The day was hot, the man was lazy, and, instead of going round the brickyard he crossed over the bricks, still not dry, and he left the impression of his nailed sandals upon them. Here is one—the actual impress of a Roman soldier's sandal sixteen hundred years ago. But this is not all. He wanted something to do when he rested on one side of the brickyard, and in a fit of idleness he scribbled his own name again and again on one of the large tiles. Here is the tile. His name, Bellicianus, has thus, by his idle fit, become immortalised amongst the descendants of what he then considered a barbarian tribe. This is no fancy: it is an actual account of what must have happened. And surely there is—there must be—a great interest in looking back thus for centuries, and seeing, as it were, the actual events of those times. History gives them, it is true: but archæology paints them as in a picture; and, though not so really important as any of the exact or the natural sciences, yet it is undoubtedly of the greatest importance as a handmaid to history.

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The Woolhope Naturalists' Field Club.

SYMOND'S YAT AND BUCKSTONE MEETING.

JUNE 15, 1875.

The following is a list of the members of the Woolhope and Cotteswold Naturalists' Field Clubs present at the joint meeting at Ross, Symond's Yat, The Buckstone, and Monmouth, on Tuesday, the 15th instant :—

Woolhope—Rev. C. J. Robinson (president) and friend, H. C. Moore, Esq., T. Clifton Paris, Esq., W. A. Swinburne, Esq., Revds. G. H. Clay, T. P. Monnington, A. G. Jones, R. H. Williams, W. Wyatt, Stephen Thackwell and friends, Captain Underwood, Mr. Pechell and Mr. Arthur Thompson (treasurer and assistant secretary).

Cotteswold Club—T. B. Ll. Baker, Esq., F.S.S. (Hardwicke Court), Thomas Wright, Esq., M.D., F.R.S.E., F.G.S. (Cheltenham), vice-presidents; William Henry Paine, Esq., M.D., F.G.S., F.M.S. (Stroud), honorary secretary; Major Barnard, Mr. John Bellows, Rev. E. Cornford, Edward Cripps, Esq., Ernest Hartland, Esq., George Hepworth, Esq., Thomas Lancaster, Esq., F. D. Longe, Esq., Thomas Marling, Esq., and son; J. Price Moore, Esq., John Daniell Thomas Niblett, Esq., Rev. E. R. Nussey, George Serrocold, Esq., John Hooke Taunton, Esq., M.I.C.E., F.G.S., Charles Wethered, Esq., Edward Wethered, Esq., J. P. Wilton, Esq., Captain Winthrop, R.N., E. Witchell, Esq., F.G.S., Dr. Bond, Mr. Walker, Mr. William R. Paine.

They were met by the following members of the Woolhope Club at Symond's Yat Station :—Colonel Byrde, S. R. Bosanquet, Esq. (Dingestow Court), and W. W. Phillips, Esq., and also by the following at dinner at the Royal Hotel, Ross : —Lieut.-Colonel Symonds, Timothy Curley, Esq., Alfred Purchas, Esq., and Lewis Sargeant, Esq.

The following gentlemen were elected annual members of the Woolhope Club :—J. W. Lukis, Esq. (president of the Cardiff Naturalists Society), Mr. W. Watkins Old, William W. Phillips, Esq. (The Grange, Raglan), Rev. F. C. Stebbing (Kingstone, Hereford), Stephen Vernon, Esq. (Newport, Monmouthshire), R. F. Woollett, Esq., M.D. (Castle House, Caerleon).

After dinner a paper on the Botany of the district was read by Mr. Henry Southall.

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ON THE BOTANY OF THE NEIGHBOURHOOD OF ROSS, AND THE LOWER PORTION OF THE WYE VALLEY,

By Mr. Henry Southall.

In giving some account of the more interesting plants to be found in the above district, there will be no attempt to present an exhaustive essay on the subject, or even to furnish a complete list of its flora, but we shall confine ourselves to a hasty sketch of what has come under our own notice in the course of rambles in the locality extending over a period of more than twenty years. Many of these have been so pleasant and delightful that it is more than possible that an undue partiality may be shown to what we shall be excused for considering one of the most rich and varied in its vegetation of any equal area in the United Kingdom, viz., the Doward Hills, Symonds' Yat, and the Coldwell Rocks.

In this locality, in a geological point of view, perhaps the most interesting feature may be the junction of the Old Red Sandstone with the Mountain Limestone, of which latter formation most of the Crags over-hanging the Wye are composed, whilst large masses of conglomerate obtrude in places from the hill sides, occasionally forming blocks in the bed of the river, where no doubt they have rolled, when loosened from their former beds.

I mention this as explanatory of the character of the soil, upon which so much depends as regards the plants and trees growing on it.

Another noticeable feature of the neighbourhood is the large extent of woodland and the luxuriance and the great variety of the trees with which the tops and sides of the hills are clothed, in this respect presenting a marked contrast to Yorkshire, where the timber, especially in Wharfdale, is pretty much confined to the valley, leaving the higher ground nearly bare.

Indeed much of the beauty and picturesqueness for which the Wye scenery is so celebrated, particularly in Spring and Autumn, is due to the different colors and foliage of so large a number of almost every kind of tree, many appearing to be indigenous to the soil.

Two or three varieties of the Oak are met with. Mr. Babington, however, does not admit that there is more than one species of Quercus in Britain.

The beeches, sycamores, chestnuts, and birches attain to great size. The large and small leaved varieties of the lime are seen growing close together.

The Yew is very abundant and seems to favour the line of the conglomerate strata.

The genus *Pyrus* is not only represented by the Crab Tree *(Pyrus malus)* and the mountain ash *(Pyrus aucuparia)* but by the service tree *(Pyrus torminalis)* as well as the *Pyrus scandica* and *Pyrus latifolius*, and the white beam *(Pyrus aria)* remarkable, not only for its bunches of white blossoms when in flower, and of berries when in fruit, but for the whiteness on the under sides of its soft and

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downy leaves, which when shaken by the wind present quite a striking appearance. The sloe and bullace (*Prunus spinosa* and *insititia*) the dwarf and wild Cherry (*Prunus cerasus* and *avium*) are common, but the bird Cherry (*Prunus Padus*) is very local. The two Buckthorns (*Rhamnus catharticus* and *frangula*), the spindle tree (*Euonymus Europœus*), the dog wood (*Cornus sanguinea*), the Guelder Rose (*Viburnum opulus*), and the wayfaring tree (*Viburnum lantana*), together with an almost endless variety of Roses and Rubi (amongst them some considered very local by Mr. Baker), these with the black and red Bryony (*Tamus communis* and *Bryonia dioica*) the Honeysuckle and the Elder, of which three separate kinds may be noticed, of which the Danewort is most curious—are specially ornamental either from their foliage, fruit, or blossom. And if we add the poplar and willow, the former often filled with mistletoe, and the latter with its never ending varieties, puzzling even those who have made them a life-long study, together with the common and Wych Elms, the Ash, Maple, Alder, Hazel, and Hawthorn, as well as the Scotch, Spruce and Larch Firs, we shall have made a considerable selection from our list of Forest Trees. And now whilst on the subject of woods we may inquire what ferns and other plants are to be found growing in them. Not to mention particularly those which are almost universal, such as primroses, anemones, blue bells, &c., we may note the cow-wheat (*melampyrum pratense*), the wood sanicle (*Sanicula Europœa*), the sweet woodruff, wood Betony, the *Luzula forsteri*, *borreri*, and *pilosa*, three not very common species of the wood rush and the Spurge (*Euphorbia amydaloides*) as almost everywhere exceedingly abundant. The Caper Spurge (*Euphorbia lathyris*) has been found recently near Welsh Bicknor, and the only locality in Britain for the *Euphorbia Stricta* is near Tintern.

The wood laurel (*Daphne Laureola*) occurs frequently. The bear's foot (*Helleborus viridis*), with its handsome digitate leaves and green flowers, is found in one locality only. The setterwort (*Helleborus fœtidus*) grows in two or three places, some very fine plants of which have been seen this year. The lily of the valley (*Convallaria majalis*) and the Solomon's seal (*Polygonatum multiflorum*) in two or three places only. The herb Paris, plentiful in a few localities, but rather shy. The barberry (*Berberis vulgaris*) and the box, also scarce. The columbine (*Aquilegia vulgaris*) is another interesting plant, and one of the commonest of all is the traveller's joy or honesty (*Clematis vitalba*) covering the hedges with its feathery masses. The two periwinkles, *vinca major* and *minor*, several of the *orobanches* or broom rapes, with their brown, weedy, withered-looking flowers, and parasitical on the roots of hazel, the singular tooth-wort (*Lathrœa squamaria*), and under the beech trees occasionally in autumn, the yellow bird's nest (*Monotropa hypopitys*).

The lesser winter green (*Pyrola minor*) very shy, but very graceful, and near it the pretty little *Rubus saxatilis* are to be found at the Wynd Cliff, as well as *Sedum rupestre* and *Saxifraga hypnoides*. The wild lettuce (*Lactuca virosa*) grows on Doward, as well as the small teasel, or shepherd's rod (*Dipsacus pilosus*). We have also a fair sprinkling of orchids. The fly, frog, and bee orchis are abundant in some years, while in others scarcely to be met with.

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The butterfly and bird's nest ditto are generally very plentiful. The true *O. Bifolia*, however, is only found in a place or two, as likewise the pretty little ladies' tresses (*Spiranthes autumnalis*). The *Helleborines*, *Cephalanthera ensifolia*, and *grandiflora*, and *Epipactis ovalis* are quite rare, and found only occasionally.

As an illustration of the curious way in which orchidaceous plants spring up suddenly in fresh spots, we may mention the finding near Bromyard a few years ago of the *Epipogon aphyllum*, which has never before or since been gathered in Britain.

In addition to the above we may include the aromatic *Orchus conopsea*, the rare *pyramidalis* with its beautiful close crimson spike, also *Orchis ustulata* and *latifolia*. One other scarce plant may be noticed as growing very sparingly in one spot, on a very thick part of the woods, the *Cynoglossum montanum* or wood hound's-tongue, the other species being particularly common.

About 27 species of ferns (not including the minor varieties) are to be found round Ross, that is if we extend the boundary as far as the Black Mountain, where the *Asplenium viride* and *Aspidium Thelypteris* are both found.

The Royal fern, *O. regalis*, however, can scarcely be said to grow now, as it appears to have become extinct, one lady in her zeal (as it is reported) having sent a wagon to transplant it to her fernery.

Fragilis was plentiful a few years since on the Coldwell Rock, but is now nearly gone. *Robertianum* or *Calcareum*, the limestone polypody still abundant, although a very good locality has been temporarily destroyed by railway quarrying.

The sweet-scented *Œmula* has hitherto only been found very scantily growing under the base of a rock. The adder's tongue and moon-wort, both grow near us. The "oak" fern is plentiful on the borders of the Forest of Dean, but the "beech" fern much more rarely. Perhaps in few places do the "hart's tongue" and other commoner ferns grow in greater profusion or strength than in our woods. Several rare grasses are met with, such as the *Bromus erectus*, *Melica nutans*, *Hordeum sylvaticum*, *Alopecurus fulvus*, *Bromus secalinus* and *velutinus*, *Brachypodium*, *pinnatum*, *Calamintha epigejos*, or the wood reed, &c., &c. The "drunken darnel," as it used to be called (*Lolium temulentum*) the only poisonous grass in England, sometimes comes up in the rectory glebe near Ross.

We have also the *Gagea lutea*, or yellow star of Bethlehem, apparently wild; the other species *Ornithogalum nutans* and *umbellatum* being apparently garden escapes. The evergreen *alkanet* (*Anchusa sempervirens*) with its intensely blue flowers, and the Deptford pink (*Dianthus armeria*), are both good plants. Then of plants used for medical purposes, in addition to some before named, we have the *Digitalis* in profusion; the deadly nightshade (*Atropa belladonna*) with its potato-like haulm, its dull purple flowers and black currant-like fruit.

The Elecampane (*Inula Helenium*) with its soft downy leaves, two feet long, and its large sunflower blossoms. The Henbane (*Hyoscyamus niger*) scarce and uncertain in its growth. The mother's wort, or as it is called by the villagers "the Hand of God" (*Leonurus cardiaca*) a plant held in great veneration by some.

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The *colchicum*, *valerian*, and *gentian* and many others. The *Valeriana rubra* is very fine on the Chepstow rocks, where a white variety also occurs.

And now as we have pretty well explored the woods, let us take a peep at some of the projecting ledges of limestone rock, and we shall find in very early spring the *Carex clandestina*, *montana*, and *digitata*, and the *Hutchinsia petræa* or rock cress, all very scarce plants. Later on, the pretty little dropwort (*Spiræa filipendula*) the rock rose (*Cistus Helianthemum*) and a profusion of *Geranium sanguineum*, sometimes quite a splendid sight, as also the horse-shoe vetch (*Hippocrepis comosa*).

Water plants are perhaps not quite so numerous as some other kinds, from the comparative absence of bogs and wet places. We can boast, however, of a pretty large variety. The arrow head, and flowering rush, are both found in the Wye, and on its banks.

The celery (*Apium graveolens*), meadow rue (*Thalictrum flavum*), the purple loose strife (*Lythrum salicaria*), the yellow ditto (*Lysimachia vulgaris*), the large *Campanula latifolia*, also *C. Patula* and *rapunculus*.

We have also the bog bean, bog asphodel, sun dews, butter wort, mare's tail (*Hippuris vulgaris*), cotton grass (three species), equisetum, and chara, &c. Also a considerable number of maritime plants on the tidal banks of the river, which are scarcely worth mentioning. We must not, however, forget one relic of monkish times, found in the meadows near Tintern Abbey. The purple goat's beard, or "Go to bed at noon" (*Tragopogon porrifolius*), so called from its shutting up after mid-day.

But we have already extended our ramble far enough, and, fearing we may have tired you, have only to offer our humble apology.

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The Woolhope Naturalists' Field Club.

MEETING AT SKENFRITH AND GROSMONT.

JULY 18TH, 1875.

The third field meeting of the Woolhope Naturalists' Club was held on Tuesday last, in the Vale of the Monnow. The curious columbarium of the Knights Hospitallers at Garway was inspected, and a visit paid to the adjoining church, which contains among other features of interest a chancel arch, the outline of whose soffit is cut so as to form a series of projecting trefoils. It has a rather Saracenic look, and is probably unique in construction. A suggestion was made by the Rev. H. Cooper Key that the segments of the arch had once formed, or had been designed to form parts of a pillar, and that their unique appearance was due to their position. However this may be, it is tolerably evident that this peculiar arch has been attached to the Norman arch at a later period—possibly when the rood loft was added In the passage leading to the detached belfry, a stone cross of unusual character was found some years ago. In its centre is a lozenge within which is carved a hand with three fingers uplifted, supposed to have been an emblem of the Knights Templars who preceded the Hospitallers in their occupation of Garway. It is much to be hoped that this stone, which is now in the custody of the Vicar of the parish, will be restored to the church without delay.

The Club next proceeded to Skenfrith Castle and Church—the former a border fortress of trapezium shape with a circular keep, but too much shrouded with trees and ivy to admit of close examination; the latter, an interesting building with a very picturesque half timber tower. Among its features was noticed an incised slab to the memory of John Morgan, and Anne his wife, (1557-1564); and in place of an altar cloth, a velvet cape beautifully embroidered in gold thread, with designs of angels, fleurs de lys and oriflammes. Skenfrith Castle was often visited by John and Henry III. and probably fell into ruin after Glyndwr's rebellion.

The same fate befell the neighbouring and more important fortress of Grosmont, which was next visited by the Club. Within its walls was born the heroic Duke of Lancaster, known as Henry of Grismont, (still the local pronunciation of the name); and outside them Prince Henry (afterwards Henry V.,) defeated the insurgent Welsh in 1405. The history of the district was detailed in the following paper by the President :—

ADDRESS BY THE PRESIDENT, READ AT SKENFRITH.

We hold our Meeting to-day in a district remarkable not only for the beauty of its natural features, but also for the historical interest which attaches to it. We

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are in what was formerly called the Marches of Wales, and as the history of the name is in this—as in so many other cases—the history of the thing, I must ask you in the first place to listen to a little etymological discussion.

About the year 585 an Anglian Chief named Crida (who is thought to have left his name in Credenhill) crossed the Severn and subdued the Silurian tribes, which occupied the country between that river and the Wye. He erected the conquered country into a kingdom to which was given the name of Myrcna-ric (Latinised as Mercia), because it formed the frontier province between the Angles and the Welsh. The same name—Marcia—is borne by a province in Spain and for the same reason. In both cases it meant the district of the "march" or *margin*, the *demarcation* between two alien races. And we find the term entering into the composition of the names of similarly situated districts throughout Europe. Thus *Denmark* was the Danish frontier, *Finmark* and *Lappmark* the provinces wrested by Scandinavian invaders from the Fins and Lapps, *Steyermark* (or Styria) the boundary between the Germans and the Croats. Single places also bore the name. *La Marche* in the Vosges used to be one of the border towns of Alsace, but of course has now been annexed to Germany, and in England we have *March* in Cambridgeshire, situated on the division line between the Danish and Anglian settlements, and the same name applied to part of Herefordshire and Shropshire, and forming the title borne by the noble family of Mortimer.

Our own Mercians or March people were a decidedly aggressive race, and by the middle of the 8th century they had absorbed the territory of the Hwiccas (Worcestershire and Gloucestershire), the S. Angles and the M. Angles—in-fact, they had gained possession of all the central part of England. Of course with this extension of territory the original significance of the name was impaired, and when —two centuries later—Athelstan crushed both Britons and Danes, it was merged in the general term England. Not that it then finally disappeared, for the province of Mercia continued to exist, governed first by ealdormen and then by earls, until the great change which was brought about by the Norman Conquest.

But the Marches—using that term in its more precise and earlier signification—retained their former character even though their dimensions were curtailed. They were still a border district, the scene of incessant strife, harassed by alternate raids and reprisals, and suffering almost as much from the exactions of the feudal lords who claimed dominion over them as from the invasions of their hostile neighbours. Monmouthshire, it must be remembered, was not constituted a county, until the 12th century, thus at the date of Domesday Survey (1086) the town of Monmouth, the Castle of Caerleon, and the district of Archenfield, were included in Herefordshire, and the country about Llanvair and Portskewit was reckoned part of Gloucestershire. All west of the Usk was regarded as being in Wales, and the particular district in which we now stand was probably included in what was called Went or Gwent Wood, the word Gwent (meaning perhaps fair or bright) is preserved to us in Kentchurch. Where then were the Marches of Wales? We can give no *precise* answer to that question, but many say that they included all the country contiguous to the Welsh boundary. Under the Conqueror

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there were three Earldoms of the March—Chester, Shrewsbury, and Hereford, and, we are told, that the duty of the March Earl in England was (like that of the analagous Margrave in Germany) to defend and to extend the March or Pale, and generally to spoil the enemy's borders adjoining. It would be impossible to lay down accurately the limits of a district which was necessarily in a constant state of fluctuation. Even at the end of Henry III.'s reign, 1263, we find stated in Rymer s Fœdera that the Welsh invaded and laid waste the lands in the March almost as far as Weobley, Eardisley and Wigmore. So the pale at that time must have been drawn not far short of the city of Hereford itself.

It will be easy to gather from what has been said that the great object of the Earl of the March and of the mesne lords who held under him must always have been to strengthen their positions on the border and to be continually pushing them further westward. And these no doubt were the causes which led to the foundation of so many castles in this part of England. They were aggressive rather than defensive posts. They were designed not merely to overcome the Welsh and keep them in check, but also to serve as convenient points from which to harass the enemy and levy black mail upon him. Of course there was plenty of retaliation, and the Welshman who had plundered and got away would be every bit as safe in his own mountains as the Norman would be in his Castle. It may be as well to mention here that the earliest Norman Castles were generally nothing but a single square tower of immense solidity and buttressed at the angles. The windows and entrance doorway were at a considerable height above the ground, and the basement story was built of such ponderous masonry as to defy all attacks upon it. The inmates were therefore safe from assault, but their quarters being limited they could be starved out, if the beleaguering host could keep their ground. To meet this difficulty additions to the original structure began to be made in the Great Castle-building era of King Stephen, and a part of the adjoining ground was enclosed with high walls and protected, if need required it, by a fosse or ditch. These outworks gradually increased in importance till in the Edwardian era—the latter part of the 13th century—the enclosing walls and towers, with entrance gateway, portcullis and moat constituted the most important features of the fortress. The Norman Keep (if there had been one) was retained as a place of final retreat, but its internal arrangements underwent many changes, and it will often be found that the windows were enlarged at this period and many of the earlier characteristics destroyed. At what date the three border fortresses of Skenfrith, Grosmont, and Llantilio or White Castle were built we have no means of ascertaining with certainty. All three are mentioned in a document in the British Museum, (Cotton M.S., Vest. A., xviii., 159) which is attributed to the early part of the reign of Henry III., and they were certainly in existence in the time of King John. It is not an improbable supposition that their origin was due to the energy which King Henry I. displayed in checking the Welsh and repressing their turbulent inroads.

In Skenfrith Castle we have as you see, a fortress of mixed character. The The circular keep is of Norman date, while the curtain walls strengthened by towers at the angles belong to the later or Edwardian era. At Grosmont the

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remains are more important and belong almost entirely to the later period when the Border Castle was doubtless refitted for the purpose of forming a residence for the Duke of Lancaster. You will find there a hall 80 feet long by 27 feet wide, lighted by five windows, and with indications of having been a really noble apartment. A chimney shaft of decorated work is a conspicuous feature and has been often engraved.

The first notice we can find of Skenfrith is in the Chancery Rolls belonging to the third year of King John's reign, 1201, or 1202. Mention is there made of a sum of money, £14 18s. 5d. expended out of the royal treasury in the repair of the Castles of Hereford, Grosmunte, Blaunchcastell, and Schenefrid. No doubt the object of this expenditure was to put the Castles into such a state of defence as could enable the king to keep in check the Welsh, who were growing troublesome. But within a few years (March, 1204, and again January, 1206,) the king found it necessary to proceed in person to the border, for the lords of the Marches—and particularly William de Braose, the powerful baron who held most of this country, had become disaffected and joined cause with the turbulent Welsh. However, de Braose and the king made up their quarrel, and the latter restored to the baron his Castles of Grosmont, Skenfrith and Lantely, and accepted in return 3 steeds, 10 greyhounds, and some other gifts. But the reconciliation does not seem to have been complete, for we learn from the Close Rolls that the castles were *not* surrendered, but on the contrary were fortified for the king by Hubert de Burgh, who had been appointed Warden of the Marches. By the 18th December, 1206, matters had been so far settled that Walter de Clifford, Sheriff of Herefordshire, was ordered to put into the hands of William de Braose his three fortresses, and for a while there was peace between the rival powers. But year after year the king came westward endeavouring to force an allegiance, which year after year was rendered with greater reluctance. At length the rupture with the barons took place, and John found that they had made common cause with the insurgent Welsh, and were in possession of all the strongest points upon the border. By vigorous measures he was enabled at the outset to recover some of the ground that had been lost, and by the close of the year 1214, he had seized on Grosmont and the neighbouring castles, and having placed his own garrisons in them had entrusted them to the care of his faithful partisan, John de Monmouth. But in the following spring the tide of success was turned. Llewelyn invaded England, and the barons, including Giles de Braose, Bishop of Hereford, united with him and secured the border castles throughout the whole length of the Marches. The king could make no head against the opposition, and on the 15th June, 1215, signed the Magna Charta. By some means or other he seems also to have regained possession of these South-western Castles, for by the end of the year they were restored to the custody of John de Monmouth. Nor did they change hands again for some time, for when Henry III., visited the border in 1220 and again in 1221—to check the threatened inroad of Llewelyn—Scenfrith Castle afforded him shelter, and it was in this neighbourhood that he met with most success. It would be tedious work to narrate the continually recurring disputes between Henry and the barons, and the successive invasions of the March district by Llewelyn and the Welsh. But in 1233

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the opposition to the king assumed a formidable aspect. The Earl Marshal joined the revolted barons; Hubert de Burgh, rescued from prison, threw in his lot with the outlaws, and Llewelyn strengthened the cause with a numerous army of sturdy Welshmen. Henry mustered his forces—composed largely of Flemings and other foreigners —and marched to Hereford. But he found that the barons had carried off all the cattle and other effects from the surrounding country and that his vast host were without provisions. He therefore retired to the Castle of Grosmont "intending to remain there some days, and, confident in his numbers, encamped negligently in the fields outside the Castle. The barons, who had good intelligence, were informed of his position; the Earl Marschal refused to join in an attack upon the person of the King, but the other confederates marched during the night with a numerous army of English and Welsh, and at day-break on the feast of St. Martin (November 11) fell upon the Royal Camp, drove away the Knights and Soldiers without striking a blow and made themselves masters of above 500 horses and all the equipage and luggage of the Camp. The King was safely lodged in the Castle of Grosmont, but he lost all his money and provisions, and many of his principal men were obliged to fly almost in a state of nudity." *(Wrights' Ludlow, p.p. 159-160).*

The king fled to Gloucester. Grosmont, Skenfrith, and Lantillio Castles after having been retained awhile by a garrison of Fleming's, who were a terror to the neighbourhood, were transferred to the care of Hubert de Burgh, then restored to favour. In 1238 he surrendered them to the king, and we hear little of them again until early in the next century. At that time Grosmont was occupied by Henry, Earl of Lancaster, and within its walls was born the heroic Duke of Lancaster, (surnamed of Gresment) one of the noblest knights who fought beneath the standard of Edward III. Throughout the reign of that monarch the castles were kept in a state of complete defence, but it does not appear that they were ever assailed, in fact, we find no event of any importance in connection with them until the revolt of Owen Glyndwr in 1405. That chieftain (who to my mind stands on a far lower elevation than Llewelyn) had in the previous year met with the greatest success in invading and laying waste the western side of Herefordshire, and encouraged by this circumstance and by the addition of a French contingent to his army he renewed the campaign with increased vigour. Prince Henry (afterwards Henry V.,) was despatched by his father to Hereford, and heard that a body of 8000 Welsh had made a sudden attack on Grosmont and burnt part of the town. The prince hastily collected a small force, marched rapidly to Grosmont, and on March 11th, defeated the invaders with great slaughter. *It is said* that 800 or 1000 Welsh were left dead upon the field: Glyndwr's brother Tudor, was among the dead, and his eldest son Griffith, who commanded the expedition, was taken prisoner.

The border castles suffered a good deal in the constant warfare caused by Glyndwr's rebellion and probably then fell into ruin. Symonds, who visited Grosmont in 1645, with King Charles' troops, mentions having noticed "the walls of an old castle on the north side of the towne, moted but in part dry, upon the

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quarry of stone." And of Skenfrith and White Castle he merely remarks that they were "ruined." Thus ends their story. But, through the instrumentality of one of our members, Rev. T. W. Webb, I am able to add a little further information. Some twenty years ago he visited the Skenfrith Castle and was then told by the man in charge that he had found on the outer slope, or glacis, at the foot of the keep, an arched passage supported by pillars on either side and leading to the base. He covered up the entrance without exploring its limits, being either ignorant of the traditionary treasure within, or over-awed by some glimpse that he may have caught of its dread custodians. As there may be among the members of the Woolhope Club some few who are unacquainted with the popular story, I will quote from Wright's History of Ludlow, a curious letter on the subject addressed by Wm. Hobbye (then a prisoner in the tower of London) to Lord Treasurer Burghley, dated 28th April, 1589.—"Leave your Lordship to understand that there is a castell in the parish of Skemfyth in the countie of Montgomerie (*sic*), your lordship graunt full authoritie unto myne owne self, I am a poore subject of the queenes, if there be any treasure there, your lordship shall know it, for by the voice of the country there is treasure. No man in remembrance was ever scene to open it, and great warrs hath been at it, and there was a place not farr from it whose name is Gamdon, that is as much as to say the *game is done.* Pray you, goodly lord, give letter to the castle, using your lordships free authoritie to open, and if treasure be there, I will use it as it ought to be, and I will stand for your lordship's consideration and give me what you please. For the country saieth there is a great treasure. The voyce of the country goeth there is a dyvell and his dame, one sitts upon a hogshed of gold the other upon a hogshed of silver, yet nevertheless with your lordships full power and authoritie they shall be removed by the grace of God, without any charge to the queene and your lordship. If treasure be there, then I will looke for something at your hands. So praying your lordship's answer for the present despatche, so I bid your lordship farewell."

I cannot do better than echo the last word of this petition and at the same time thank you for lending a more ready ear to my words than was probably vouchsafed by the Lord Treasurer to those of the unfortunate Wm. Hobbye.

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CORTINARIUS SAGINUS. FR.

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The Woolhope Naturalists' Field Club,

OCTOBER 14TH, 1875.

On the return of the members of the club from the Fungus Foray in the grounds of the Rev. G. H. Davenport, at Foxley, the following assembled in the club room, at the Free Library, for the transaction of business: Rev. C. J. Robinson, President, in the chair; Sir William V. Guise, Bart., President of the Cotswold Naturalists' Club; Mr. Edwin Lees, President of the Malvern Naturalists' Club; Rev. Wm. S. Symonds, Vice-president of the Malvern Naturalists' Club; Mr. Orlando Shellard, Mr. Thomas Cam, Mr. James Rankin, Mr. W. A. Swinburne, Dr. Chapman, Dr. Mc Cullough, Rev. J. F. Crouch, Rev. James Davies, Rev. H. W. Phillott, Rev. Stephen Thackwell, Rev. R. H. Williams, Mr. Edwin C. Scobell, Mr. Joseph G. Alexander, Mr. With, and Mr. Arthur Thompson, Treasurer and Assistant Secretary.

The following officers were appointed for the year 1876; they will not take office until after the Annual General Meeting to be held the early part of next year. President: Rev. Sir George H. Cornewall, Bart., Moccas Court, Hereford. Vice-presidents: Rev. William Jones Thomas, Llanthomas, Hay; Mr. James Rankin, Bryngwyn, Hereford; Rev. C. J. Robinson, Norton Canon, Weobley; Mr. Wm. A. Swinburne, Dulas, Hay. Central Committee of Management: Mr. Timothy Curley, Hereford; Mr. Charles G. Martin, Hereford; Mr. J. Griffith Morris, Hereford. Treasurer: Mr. Thomas Cam, Hereford. Editorial Committee: Rev. Sir G. H. Cornewall, Bart., Moccas Court, Hereford; Rev. Charles J. Robinson, Norton Canon, Weobley; Rev. James Davies, Moor Court, Kington; Mr. James Rankin, Bryngwyn, Hereford; Rev. H. Cooper Key, Stretton Rectory, Hereford; D. M. McCullough, M D., Larchfield, Abergavenny; Rev. H. W. Phillott, Staunton-on-Wye, Hereford. Secretary: Mr. Arthur Thompson, 12, St. Nicholas-street, Hereford. Mr. Stephen Robinson, Lynhales, near Kington, was elected an annual member of the club.

After the transaction of the above business, a paper was read by Mr. Worthington G. Smith, F.L.S., "On the Anatomy of an Agaric," illustrated by diagrams.

The following gentlemen were appointed a committee to examine and draw up a report upon the exhibition of fruit: Mr. Thomas Cam, Hereford; Mr. F. W. Herbert, Credenhill Park, Hereford; Mr. James Rankin, Bryngwyn, Hereford; with Mr. Chapman, Librarian of the Free Library, Secretary.

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Among the 61 gentlemen present at the dinner at the Green Dragon Hotel, Hereford, and others who joined the party during the day, we noticed the following :—The President, the Rev. Charles J. Robinson, Norton Canon; Sir William V. Guise, Bart., F.G.S., Elmore Court, Gloucester, President of the Cotswold Naturalists' Field Club; Edwin Lees, Esq., F.L.S., F.G.S., &c., President of the Malvern Naturalists' Field Club; Rev. William S. Symonds, F.G.S., Pendock Rectory, Tewkesbury, Vice-president of the Malvern Naturalists' Field Club; Mr. C. E. Broome, F.L.S., &c., (Bath), Dr. Cooke, Dr. McNab (Dublin), Rev. William Houghton, M.A., F.L.S., &c. (Preston, Salop), Mr. Houghton, Major Houghton, Mr. Cecil H. Spencer Percival (Clifton), Mr. William Phillips (Shrewsbury). Mr. E. Pateshall, M.P., Mr. Charles B. Plowright (King's Lynn), Mr. James Rennie (Rotherfield, Sussex), Mr. Worthington G. Smith, F.L.S. (London), Rev. J. E. Vize (Welshpool), Mr. O. Shellard (Mayor of Hereford), Mr. Joseph G. Alexander, Mr. Edward Alexander (Cirencester), Dr. Bull, Mr. Cam, Dr. Chapman, Dr. McCullough, Rev. J. F. Crouch, Rev. James Davies, Rev. W. C. Fowle, Rev. J. E. Jones-Machen, Mr. George Cocking, Mr. Timothy Curley, Rev. Canon Girdlestone (Gloucester), Mr. W. C. Gibson (Leamington), Dr. Davies (Ebbw Vale), Mr. F. W. Herbert, Mr. J. Bowle Evans, Captain Minshull Ford, Mr. H. A. Dean, Mr. W. Toms, Mr. Joseph Greaves, Rev. William Jones Thomas, Rev. A. G. Jones, Mr. Theo. Lane, Mr. H. C. Moore, Rev. W. H. Mills, Mr. Fortey, Mr. C. Fortey, Mr. J. Griffith Morris, Mr. Morris, jun., Rev. G. M. Metcalfe, Rev. J. Norton, Rev. H. B. D. Marshall, Rev. H. W. Phillott, Mr. James Rankin, Mr. Edwin C. Scobell, Mr. Lewis Sergeant, Rev. B. L. S. Stanhope, Rev. F. C. Stebbing, Mr. J. F. Symonds, Mr. Reginald Symonds, Mr. W. A. Swinburne, Rev. Stephen Thackwell, Dr. Vachell (Cardiff), Rev. R. H. Williams, Rev. Arthur Young, Mr. R. Walker, Mr. Wheatley, Mr. Chapman, and Mr. Arthur Thompson, Treasurer and Assistant Secretary.

At the close of the repast, the President (Rev. C. J. Robinson) briefly proposed the health of "The Queen," and then called upon Dr. Bull to give a local mycological report, and to read a short account of "A Spring Foray at Whitfield"; after which the following paper was read: "On the Colours imparted to Landscape Objects by Cryptogamic Vegetation," by Edwin Lees, Esq., F.L.S., and President of the Malvern and Worcester Naturalists' Field Clubs.

The following is a record of the apples and pears exhibited at Hereford in connection with the Woolhope Naturalists' Field Club.

When it was proposed last year that in future an exhibition of apples and pears should be held under the auspices of the Club, in connection with its usual annual display of fungi, it was admitted that the first exhibition would be simply an experimental one, to test the present interest taken in this and the adjoining counties and it has proved—both by the number of specimens of fruit exhibited, and the universal pleasure and satisfaction expressed by all who visited it—that the exhibition will become a popular one. One object of the Club will henceforth be to ascertain the correct names of the different kinds of cider, perry, cooking and

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dessert apples and pears, produced in this and the neighbouring districts; to determine the best sorts grown; and so to be able to recommend the cultivation of fruits of greater excellence in the place of existing kinds of an inferior quality.

D signifies that the varieties so marked are to be used for dessert only; K for kitchen purposes; and C for cider making. Those marked K D are useful either for kitchen or dessert use. The synonyms where given are taken from "Hogg s Manual of British Fruits."

The following is a list of the gentlemen who exhibited and the fruit exhibited by them :—

APPLES.—Dr. Bull: (K) The Wellington, or Dumelow's Seedling*; (K) Cat's-head, or Dutch Codling*; (K) New Bess Pool, seedling of Old Bess Pool*; (K) Wormsley Pippin, or Knight's Codling*. Col. Byrde: Pomme de France; Glory of England; Amret Grosgris; Amret Anglaise; (C) Loume Apple*; (K) Mairgas Tresor*; (K) Codlings*; (D) Northern Spy; (D) Lady's Fingers, or White Paradise*; (K) Waltham Abbey Seedling, or Golden Noble*; (D) Pomeroy*; (C) Normandie; (K) Bedfordshire Pippin*; Reinette d'Angleterre; (D) King of the Pippins, or Golden Winter Pearmain*; Golden Pippin; (D) Syke House Russet, or Syke House Pippin; Coudame's Apple. T. Cam, Esq.: (D) Margil, or Neverfail*; (D) Scarlet Nonpareil*; (D) Cox's Orange Pippin*; (D) Northern Spy; Peach Pippin; (D) Court o' Wick, or Golden Drop*; Rev. C. H. Bulmer, Old London Pearmain; (D) Cox's Orange Pippin*; (K) Germain Apple*; Cranstoun's Seedling; (D) Ashmead's Kernel; Morning Pippin. Rev. Preb. Davies: (KB) Dlenheim Orange, or Woodstock Pippin*; (K) Dutch Codling, or Cat's head*; (K) Golden Noble, or Waltham Abbey Seedling*; (D) Cox's Orange Pippin*; (D) Ribston Pippin, or Glory of York*; (D) Downton Pippin; (D) Franklin's Golden Pippin*; (KD) Fern's Pippin, or Clifton Nonsuch. F. W. Herbert, Esq.: (KD) Quarenden, or Sack Apple*; Queening; (D) Old Pearmain*; (C) Garter Apple*; (KD) Orange Pippin, or Isle of Wight Pippin; (K) French Crab*; Skyrme's Kernel; (D) King of the Pippins*; (D) Ribston Pippin; (C) Strawberry Norman*; (K) Hawthornden*; (C) Cowarne Red*; (DK) Cowarne Queening*; (DK) Blenheim Orange, (D) Golden Harvey, or Brandy Apple*; (D) Norfolk Biffin, or Beefing*; (K) Cat's-head, or Dutch Codling*; (K) Yellow Elliott*†‡; (C) Yellow Norman*; (DK) Garnon's Pippin, or Court Pendu Plat*; (C) Fox.whelp*; (D) Pomeroy*; (C) Upright Norman*; (C) Siberian Harvey; (D) Downton Pippin; (D) Margil, or Neverfail*; (D) Lady's Fingers, or White Paradise*; Carraway Russett; (C) Red Norman*; eight kinds unknown. A Hutchinson, Esq., Hagley Park: (D) Biddulph's Nonpareil*†; (D) Margil, or Neverfail*. J. C. Kent, Esq., Earl's Croom: (D) Chacely Harvey, or Golden Harvey*. H. C. Moore, Esq., Infirmary: (D) Lady's Fingers, or White Paradise*; (C) Red Styre*: (C) Fox-whelp*; Russets; (D) Old Pearmain*; Goose Apple; (D) Ribston Pippin*; (DK) Blenheim Orange*; (D) Nonpareil; Been Apple; Captain's Kernel; (C) Cowarne Red*; 8 kinds unknown. Rev. T. Phillips, Dewsall: (C) Fox-whelp*; (D) Pomeroy*; (D) Margil, or Neverfail*; (K) Royal Somerset, or London Pippin*; (K) Cat's-head, Dutch Codling, or

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Chalmer's Large*; Quince; 1 unknown. W. A. Swinbourne, Esq., Dulas, Hay: (D) Old Nonpareil*; (D) King of the Pippins*; (DK) Blenheim Orange*; (D) Cox's Orange Pippin*; (D) Mannington's Pearmain*; (K) Hawthornden*; Codling; (D) Golden Harvey, or Brandy Apple; (K) Cox's Pomona; 3 unknown kinds. Rev. R. H. Williams, Byford: (DK) Blenheim Orange*; (D) Ribston Pippin*; (D) Court Pendu Plat, or Garnon's Pippin;* (K) Alexander, or Emperor Alexander*; (K) Wellington, or Dumelow's Seedling*; (K) Five-nosed Pippin, or London Pippin; 3 unknown kinds.

Pears.—Rev. C. H. Bulmer, Credenhill—Gloû Morceaux, or Beurré d'Cambronne; Winter Nelis, or Beurré de Malines; Catillac, or Bon Chretien d'Amien's; Marie Louise, orBraddick's Field Standard; Josephine de Malines; Beurré Duval; Jeudmeme; Beurrê Defays; Duchesse d'Angouleme, or Duchesse; La Comice; Louise Bonne of Jersey, or Beurré d'Avranches*; Bergamot d'Esperen; Guernsey Chaumontel, or Chaumontel. Alexandre Lambre; Beurré Caprimont. Col. Byrde, Goytre House—Figue d'Alençon, Bonissime de la Sarthe; Beurré d'Alembert; Beurré d'Amanlise, or d'Amanlis; Chaumontel, or Bezi de Chaumontel; Marechal de la Cour, Beurré Magnifique, or Beurré Diel; Beurré Superfin; Doyenne du Comice*; Duchess d'Angonleme, or Duchesse. Dr. McCullough, Abergavenny—Baronne de Mello, or Adele de St. Denis; Doyenne du Comice*; Beurré Superfin*; Bezi Mai; Marechal de la Cour; Bergamot d'Esperen; Marie Louise; Gansel's Bergamot, or Bonne Rouge*; Beurré Hardy*; Monarch (Knight's); Alexander Bivort; Gloût Morceau, or Beurré de Cambronne; Urbaniste, or Beurré Drapiez*; Josephine de Malines; Marie Louise d'Uccle*; Beurré Easter; Uvedale's St. Germain, or Abbe Mongein; Beurré Diel, or Beurré Magnifique; Soldat Esperen; Doyenne Gris, or Red Doyenne; Louise Bonne of Jersey, or Beurré d'Avranches*; Nelis; Beurré d'Aremberg, or Beurré Deschamps. T. Cam, Esq.—Beurré Bosc, or Beurré d'Apremont.* Rev. Prebendary Davies, Moor Court—Beurré Easter; two unknown kinds. A. Hutchinson, Esq., Hagley Park—Broom Park, Marie Louise; Easter Beurré; Marechale de la Cour; Beurré Diel, or Beurré Magnifique. H. C. Moore, Esq., the Infirmary—Black Worcester, or Parkinson's Warden. Rev. T. Phillips, Dewsall—Brown Beurré, or Beurré Gris. W. A. Swinbourne, Esq., Dulas—Beurré Diel, or Beurré Magnifique; Louise Bonne of Jersey, or Beurré d'Avranche; Marie Louise, or Braddick's Field Standard.

Those marked with an asterisk were considered the best of their class amongst those exhibited.

† Full flavoured, handsome, and good cropper.

‡ Really good.

The Beurré Superfin was considered the best pear for present use. It is described in Dr. Hogg's Manual as "fine grained in the flesh, buttery, melting, and very juicy, with a brisk piquant flavour, and fine aroma. A first-rate dessert pear, ripe in the end of September and beginning of October. The tree is a vigorous grower, hardy and prolific, and succeeds well as a standard or pyramid."

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THE "FUNGUS FORAY."

(Daily News.)

The Woolhope Naturalists' Field Club, one of the oldest and largest of the local societies established for the practical study of natural history, has its head-quarters at Hereford, and is especially distinguished for the attention it pays to the mysteries of mycology and mycophagy. Every autumn its members meet together for what is termed "A Foray among the Funguses," and the enthusiasm displayed on these occasions is apt to excite no little amusement in the district where the search is carried on. The humorous features of the meeting were delineated last year in the pages of the *Graphic* by the skilful pencil of Mr. Worthington Smith —himself a philagaric of high repute—and it is therefore only fair to add that the picture has also a serious side. By "serious" we do not mean disastrous, for we are bound to say that as yet no ill result has followed either the foray or the feast where its spoils are discussed; we simply mean that mycology is a science of some practical importance, and that in modern England it has hitherto been unduly neglected by the botanist, the epicure, and the domestic economist. Still, in spite of the assurance that our edible fungi contain all the elements of nutrition, and are specially rich in osmazome, we doubt whether they will ever supplant, or even supplement to any large extent, the animal food which the soul of the Englishman craves. Somehow or other, the evil name which Nero's devilish deed attached to the boletus clings to the whole genus of agarics, and no one can scarcely lift an unaccustomed morsel to one's lips without fearing lest it might be

Qualem Clandius edit
Ante illum uxoris post quem nil amplius edit.

Of course, at the Woolhope Club dinner, which took place on Thursday, such alarms were absent, and the members freely partook of several edible varieties (Hydnum repandum, Coprinus comatus, Ag. arvensis, &c.), not merely snatching a fearful joy from the repast, but deliberately criticising its characteristic features. It was unfortunate that the chilly summer had checked the growth of mycelium, and consequently the show of fungi was below the level of previous years. The common mushroom (Ag. campestris) was very rarely seen throughout the Foray, and the preponderance of poisonous or suspicious agarics in the Exhibition was encouraging to those who take an alarmist view of the matter. In truth, the difficulty of laying down any rules by which the edible varieties may be distinguished from those that are noxious seems insurmountable. Even the Horatian maxim—

Pratensibus optima fungis
Natura-est; aliis male creditur.

is not altogether admissible, and there is absolutely no test of universal application. Perhaps the best thing for most people to do is to acquaint themselves with the external characteristics of the few varieties which are really useful additions to the cuisine, and leave the remainder to the professional mycologist. First in the list of edible fungi we are disposed to place the parasol mushroom (agaricus procerus),

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the delicate flavour of which is superior even to that of the champignon (marasmius oreades). The maned agaric (coprinus comatus) and the hedgehog mushroom (hydnum repandum) come next in order of merit, and from their peculiar appearance are easily identified. To these may be added the so-called vegetable sweetbread (agaricus orcella), in whose praise M. Roques becomes ecstatic, and the chantarelle (cantharellus cibarius), which happens to be particularly abundant at this present season. The Puffball (Lycoperdon giganteum) meets with general approval throughout the continent of Europe; but the specimens we have eaten in England have invariably been insipid and deficient in nourishment. Much has been said in praise of the liver fungus or vegetable beefsteak (fistulina hepatica), the red fleshy fungus which one often sees attached to the decayed stump of an oak tree. Dr. Badham says that "when grilled it is scarcely to be distinguished from boiled meat," and no doubt, when gathered at maturity, it possesses a distinctly meaty flavour, and yields a juice which might be mistaken for gravy. We should be glad to think that its use might help to keep down the price of butcher's steaks, but for ourselves we must confess that we prefer the animal to the vegetable variety, and would consign the latter to the stock-pot, where it will prove a valuable ingredient. Almost all agarics, it must be remembered, are rather rich, and should therefore be eaten in moderation. To eat them as accompaniments to meat is an obvious error; they should form a separate course, and Burgundy will be found the most suitable wine to drink with them. With regard to their cooking, it may be laid down as a maxim that they should never be boiled, but either stewed gently, and for a long time, or broiled, with salt, pepper, and butter, before a quick fire. This branch of the subject, however, is one which has nowhere received, nor can it here receive, adequate treatment. We commend it to the attention of the School of Cookery at South Kensington. The Council of that learned body might readily adopt some means by which a discriminating knowledge of fungi might be disseminated, and the edible varieties rendered most palatable. The crop of agarics is too partial and precarious to be worth regarding as a contribution to the food supply of the country; but that is no reason why it should be so totally neglected as is now the case. The Fungus Foray at Hereford has this year been fully attended, and all the leading mycologists of Britain, including Dr. Cooke, Sir William Guise, Bart., Rev. W. Houghton, Messrs. Broome, Rennie, Plowright, Dr. Bull, &c., have taken part in it. The papers read by Mr. Worthington Smith are not merely valuable additions to our knowledge of funguses, but seem to promise a solution of one of the great scientific questions of the day—the identity of animal and vegetable life.

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ON THE COLOURS IMPARTED TO LANDSCAPE OBJECTS BY CRYPTOGAMIC VEGETATION.

BY EDWIN LEES, F.L.S., &c.

I am almost ashamed, in the presence of gentlemen accustomed to scientific study and technical precision that leads on to the attainment of practical knowledge, to read a paper that appeals rather to the uninitiated, and throws no light on classification or physiology. But my friend Dr. Bull seemed to think that a few remarks of a general character might relieve the effort that is necessary to follow scientific deductions and analytical details, and as my object has always been to give popular interest to botanical study, perhaps you will allow me to give colour to a subject that too often reposes under a neutral tint, or is shadowed by a darker hue.

A subject apparent to the eye may be treated in three ways: either technically, as the describers and classifiers of natural objects do in their treatises, synopses, or fasciculi, among which you must have seen the arranged specimens in the various families of fungi by Mr. Berkeley, and various learned foreign collectors, as well as those sent out by Mr. Plowright and Mr. Phillips, and the careful descriptions by Mr. Broome, in the annals of Natural History, and the fungological arrangement by Dr. Cooke and other authors; or an artistic view may be taken, as in the illustrated publications so pleasing to contemplate, with popular readable descriptions and anecdotes; or in an economic point of view, the actual utility of natural objects may be considered, and their subserviency to the wants and appetites of mankind. Here the analysis of the chemist comes in, the morphology of plants has to be considered, and the anatomical details and obscure modes of reproduction demand the skilful use of the microscope.

But as mankind in general look to the ordinary value and use of vegetables in the way of nourishment that the palate may approve, so while approving any new luxury, they treat with contempt organisms, however curious, that can be made no edible use of. Thus the ordinary mushroom is esteemed by all classes, while all other agarics come under the general odium of frogstools and toadstools. Here our sagacious friend Dr. Bull has come to the rescue, and the lover of fungoid substances may revel in the savoury aliment that the fields produce for two months in the autumnal season. If, as Burke once said, that man is a benefactor to his country who makes grass grow where it had never grown before, so *a fortiori*, he who enables things to be eaten that were never eaten before is a still greater benefactor—provided the palate and the stomach are agreed to enjoy and digest the new viands without fear of consequences.

But, though the products of the stew-pot and frying-pan may be at times acceptable, lovers of Nature will soar above gastronomical ideas, and I am inclined to think that the eye should be pleased and instructed on landscape objects, and

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the colouring they exhibit, before due attention will be given to their study scientifically. Artists are of necessity students of local colouring, yet how few understand on what that local colouring depends, or are able to name the causes of it! A skilful landscape painter was once praising to me the banks of a retired brook, which for a long distance, he said, was beautifully verdant by an extensive growth of a kind of moss that he had not seen elsewhere. I asked him to show me a specimen, and it then appeared that his supposed moss was really a *marchantia*, which, by its close thalloid growth, often cases the banks of sequestered brooks in a peculiar manner. My friend, after this enlightenment, was induced to look more minutely into vegetation than he had hitherto done, and on visiting him the other day I found he had brought home from the New Forest, where he had been sketching, a whole bag-full of *lichens* from the old trees, there to study them at his leisure.

But people in general who are not practical students of Natural History look to the colourable aspect of things, and are attracted by landscape scenery accordingly. My own efforts have always been directed to describe the objects of Nature in popular language, and thus give an incitement to instructive observation. If this is an humble position to take, still I think it awakens attention—tends to enlarge the number of students of Nature, who are often deterred by the technicalities of science, and the continually changing nomenclature of difficult pronunciation that of late years has been especially introduced in the departments of Botany and Palæontology.

But to come at once to the purport of my paper, I would remark that it is by no means generally acknowledged that the lower tribes of vegetation often impart a peculiar character and colouring to the landscape, and non-scientific observers do not understand the nature of what they perceive, though fully obvious to the eye. Poets and painters, who ought to be close observers as to what gives colouring to objects, yet seldom do more than take a superficial look. Thus Crabb mentions :—

> The wiry moss that whitens all the hill,

not apparently aware that this gray moss is in reality the the Reindeer Lichen, that on waste heaths and the dreary mountains of the north gives such a peculiar feature to the treeless landscape. So Southey, noticing an old decrepid apple tree, hoary in its aspect as a gray-haired man, calls the *Usnea*, that depends its lichenic filaments there, a moss, though it is well-known to the Naturalist that while the majority of lichens are gray, hoary, or gloomy-looking, the extensive tribe of mosses are mostly green.

The mosses, however, in all their verdant beauty do cover eminences to a great extent, as may be noticed on the Malvern Hills, where, except grasses and gorse, but few other plants are to be found. So old roofs and thatched barns and cottages assume the liveliest green tints as winter approaches. Hence an observant poet is correct when he says—

> When on the barn's thatch'd roof is seen,
> Mosses in tufts of liveliest green,
> When flowers are dead and all is drear,
> Be sure that Christmas-tide is near.

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As a contrast to this general verdure of mosses, boggy places may be noticed where they are marked to the eye by the investiture of the gray, melancholy-looking *Sphagnum*, dangerous to tread upon.

We are all so familiar with the aspect of ferns—green, as fringing rocky lanes with their elegant fronds, or in autumn showing an extent of rich sienna-brown, where the Eagle Brake *(Pteris aquilina)* revels to a wide extent in parks, heaths, and forest ground as a covert to game—that I need not dwell on the beauty of ferns, though I can scarcely avoid a note of admiration to rocks where they dangle, or the effect of masses of the parsley-leaved fern *(Allosorus crispa)*, on the Welsh mountains.

I rather wish to refer to the humbler cryptogamic tribes, that by their congregated numbers and confluence tint rocks and hills, and emblazon their rigidity.

Among these Lichens take an important place, for maritime rocks are often resplendent with orange, yellow, or burnt-sienna tints from the various Lichens that luxuriate in the damp sea air; and I remember a range of cliffs on the Pembrokeshire coast made brilliantly golden by the spread of the brass-wire Lichen *(Borrera flavicans)* upon their rugged surface. Even among common rural objects how often long out-house roofs or stabling have the yellow Lichens that encrust the tiles lit up in colorific pomp by the descending sun, and an old broken-down half-rotten barn door is diversified by the coloured impressions of the damp fingers of time.

The rocks of Switzerland in many places are reddened to a great extent by a cryptogam called by Linnæus *Lichen Jolithus*, though now considered to be an Algal, and I observed some great rocks thus coloured on Monte Rosa, which probably derives its name from that circumstance. The buttresses of country churches and old tombstones are often reddened by this substance.

Other precipices and damp stony walls are sobered into dingy brown by the spread of *Parmelias*, or blackened by the Collemate tribe—

> The living stains that Nature's hand alone
> Profuse of life pours forth upon the stone;

and the beauty of the Map Lichen *(Lecidea geographica)* that spreads its yellow thallus cracked with black lines like the courses of rivers on a map, over granite and trap rocks in mountainous countries, has been generally acknowledged.

Many rocks and stone towers are made gray by the Crab's-eye Lichen *(Lecanora parella)*, or the Cudbear *(C. Tartarea)*, and many rocks thus whitened receive a distinctive name in Wales; and it is remarked that such rocks become peculiarly visible in dull weather, and the Welsh peasantry, taking the hint in their tempest-beaten localities, whitewash their houses all over, roofs and every part. Old trunks of trees are often coloured by Lichens and *Jungermanniæ*, and

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the turf of mountainous places produces colours from the *Cladoniæ* that vie with the tints of the gaudiest flowers, as noticed by Wordsworth—

> Ah me ! what lovely tints are there !
> Of olive-green and scarlet bright,
> In spikes, in branches, and in stars,
> Green, red, and pearly white.

But to enjoy this diversity of colouring from lichenic growth, the explorer must climb among the mountains, and although among barren cliffs and desolate scenery he will awake to glorious imaginings.

Probably the *Algæ* exercise a greater power as to the extent of colour they impart to landscape and marine scenery than even the Lichens. This is very obvious on the coast, where the ebb tide reveals the flabby fingers of seaweeds upon the dripping rocks. It is true that the commoner kinds, as *Fucus vesiculosus*, are very dingy in hue ; but among the little pools of water left in the cavities of rocks, the eye is delighted with the fairy forms and diversified colours there presented to view that emulate the tints of the brightest garden flowers ; but here I can only indicate, as time will not allow me to describe. On a grand scale the Sargasso Sea, extending hundreds of miles, is a marine spectacle often described by voyagers in the mid-Atlantic Ocean.

But I must glance a moment at the hues that arise from moisture on the ground everywhere. Notice the effect of rain after any drought. In some places a quantity of green jelly appears so suddenly produced that it was formerly supposed to have dropped from the sky, and was believed to be the residuum of a shooting star ! This is really an Algal called *Nostoc communis*, whose growth on gravelly soil from sudden rain is of the most extraordinary character, and quicker than the night-growing Agarics. Other Algals of a similar jelloid nature occur to give a green or dark brown colour to damp rocks. In exposed paths or roads long spreads of green appear from the sudden growth of the tubular *Lyngbya*, or black trails show themselves as if soot had fallen made by the combined cells of the *Palmellaceæ* or *Oscillatoriaceæ*. Under walls, too, these spread numerous crimson and deep purple blotches, commonly called gory dew, and which has been thought to be ominous of bloody deeds done or shadowed forth. This is an Algal called *Palmella cruenta*, and allied to the red snow of Alpine and Polar regions, which is coloured by *Protococcus nivalis*. The *Algæ* comprise a vast variety of forms, all variations of the simple vegetable cell, but the greatest number of the *Confervoid* tribes vegetate in water, and thus give a colour to the surface of ponds and rivers. Here they increase with wonderful quickness, and in summer time the *Enteromorpha intestinalis* becomes very conspicuous, and I have seen it covering canals for miles together. So the Water-flannel (*Zygnema capillaris*) shows itself like great cobwebs along the sides of ditches in autumn, though it is soon blanched from exposure.

The surface of stagnant water becomes in summer spread over with a green coat of *Desmidcæ*, an accumulation of vegetable cells, and another tribe colour the water of pools and canals as if they were converted into blood. I once noticed this a canal in Wiltshire, where the water was crimsoned for miles, strangely con-

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trasting with the green fields. Flat roofs are in like manner coloured after rain by the *Protococcus pluvialis*.

In the Arctic regions green and brown slimes are mentioned by Professor Nordenskjöld as covering hundreds of thousands of square miles of water, and this slime when examined was found to be made up of various species of minute cellular vegetable organisms. In like manner it is stated by Dr. Hooker in his "Botany of the Antarctic Voyage," that the waters and ice of the South Polar Ocean abound with microscopic vegetation in such countless myriads as to stain the berg and pack ice and the base of the great Victoria barrier itself wherever exposed to the swell of the sea, of a brown colour, as if the Polar waters were charged with oxide of iron. So the Red Sea produces a local Algal that has been noticed to redden its surface to such an extent that vessels have taken days to pass through it, and it has been suggested that the Red Sea has thus received an appropriate name.

Rocks are also coloured and darkened by various minute cellular organisms, either *Diatoms* or belonging to the *Desmidiaceæ*, and names in accordance with the hues displayed are given to such localities. There is in Worcestershire a range of rocks on the banks of the Severn called Blackstone Rocks, though in reality formed of new red sandstone. But the surface of these rocks is blackened to a great extent by a minute cellular Algal which gives them the appearance of having been blackened by fires. There is a curious byssoid substance of a golden colour, known as *Chroölepus aureus*, that burnishes old stone crosses, damp rocks, and occasionally trunks of trees. When once wandering in Wales, I came upon a plantation of old Larches, whose trunks were so covered with this bright-hued plant that when the sun shone upon them they appeared like pillars of gold.

But what shall I say of the Fungi? They certainly contribute to the colouring of the landscape, though in a subservient degree, because it is only in autumn that they make themselves visible in any number. Polyporus and some other genera of a persistent nature show themselves indeed at other times, and in botanical rambles I have been often struck with the appearance of large masses of *Polyporus sulfureus*, very bright in colour—often on yew trees; and of *Polyporus squamosus*, on the Ash. Among old trees in parks and forest places, various *Polypori* often make a peculiar feature, fringing decaying branches; and in the New Forest, and in Wales, I have seen old birches with such a number of the cake-like *P. betulina* upon them, that it might be supposed they were laden with fruit. On rotting boles the black glue-like *Bulgaria inquinans*, when in clusters, is very remarkable in shady silvern retreats found out by the fungologist.

But the *Agarics* and *Boleti*, where they are numerous and freshly sprung up, give a colorific featnre to the ground as soon as the mists of autumn begin to prevail, justifying Tennyson's remark as to Fungi—

> Which in autumn-tide do star
> The black earth with brilliance rare.

A friend of mine, with whom I was walking through a wood last year, and who had paid little or no attention to Funguses, was perfectly astonished at the scarlet hues of the numerous fly-Agarics (*Amanita muscarius*) that presented them-

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selves before our view, some being of extraordinary dimensions; as well as the brick red elevated *pilei* of *Boletus scaber*. The ground in fir groves is often made vividly beautiful with the golden yellow of *Boletus elegans*, or the gamboge tint of *B. flavus*, besides the purple hues that several scattered Agarics present to the wondering eye with branching coral-like tufts of *Clavariæ*. In and about the pleasant paths of groves when the autumnal breeze raises melancholy music among the dying foliage, the tops of *Agaricus emeticus* appear like purple fruit lying upon the ground, while *A. vescus* and *A. heterophyllus*, also enliven the woody scene, and several of the tall *Agaricus procerus* present a very curious aspect. The pink or carmine *pileus* of *Ag. rutilans* that affects to grow on stumps, is another attractive Agaric, and how rich *A. cinnamomeus* and *A. sanguineus* appear on their mossy beds. So the moist breath of autumn calls up new forms of vegetable morphism which might not otherwise have appeared, thus giving splendid colours to the products of damp and decay.

A Fairy Ring, if well stored with agarics in close connection with each other, is as pretty an object among moist autumnal pastures as can well be seen, and besides awakens all sorts of ideas—poetical, superstitious, and theoretical. Certainly fields are made greener from the decay of agarics growing in rings, as Shakspeare intimates, alluding to the popular idea that fairies in their circling dances made the rings:—

> The expression that it bears, green let it be,
> More fertile fresh than all the field to see.

So another author has observed, as if really believing in fairy pastime:—"Where the small people dance the moonlight is the clearest, the dew is the most lustrous, and the pasture is the greenest after." This any observant eye may have noticed, but the effect is really due to the decay of funguses thus manuring the soil. Mushrooms and puffballs, too, where numerous, if not tempting in colour, are conspicuous on the green turf by their immaculate whiteness.

While the fading groves, in the decline of autumn, rise before the eye in colorific glory, the cryptogamic botanist in his pleasant wanderings sees the ground coloured with the bright hues of *Agarics* and *Boleti* that spring up daily, in rapid succession, as if vieing with the tinted leaves; for some of the larger Pezizas, as *P. aurantiaca* and *P. onotica*, prevent fascinating patches of colour that even attract observers ignorant of their names and nature. *Peziza coccinea* presents a cup of the deepest carmine, that often attracts the most incurious, and the adornment of stumps in woodland places by species of the genera *Trichia* and *Arcyria*, that show when the *Peridia* bursts the beautiful pink or brown wool that invests the interior, is charming when the floral world exhibits only withered stalks.

The *Clavariæ*, too, like tufts of branching coloured corals, are not to be forgotten, while the flabby brown Jews' ears (*Auriculæ Judæ*) are strung on the branches of old elder trees curiously, if not invitingly together. If the weather be wet, other forms suddenly appear so obvious to rural observers, that they name the jelly-like masses of *Tremellina* "Witches' Butter," and concoct with them an ointment which witches once used.

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The smaller Pezizas are very elegant in their forms, and their mycelia sometimes so penetrate into decaying wood as to give it an abiding colour, as is particularly the case with *P. æruginosa*, its coppery green often meeting the eye in decaying wood fallen to the ground. The incrustations, as they may be called, of *Polyporus versicolor*, *Stereum hirsutum*, and others of the same tribe, cover the branches of trees more conspicuously than Lichens, and old palings beset in the same way often present tints that an artist would take pleasure to copy with his fine Raphaelite pencil. A writer on cryptogamic vegetation has said of the fungi that "in studying their history we walk amid surprises," and "marvellous are the vistas that reveal themselves," yet I think that it is scarcely to be wondered at that the autumnal scene should be beautified and coloured by so many funguses when we reflect that the air is filled with their sporules, which, when brought down by the rain, settle and multiply wherever a decaying pabulum offers them the chance of colonization.

I have not half exhausted the subject, or done it justice, and must leave some colours on my pallet, and conclude with the evidence of Dr. Badham, that "the Fungus tribe are as beautiful as the fairest flowers, and more useful than most fruits;" but to judge of this we must wander out of beaten paths, in woods and coverts, and in the most inspiring of months, when colorific beauty blends its harmonies with the autumnal landscape, and we can in a "Fungus Foray" view that diversity in form and colour, which, alas! like all earthly pleasures, has only an ephemeral existence. But as a philosophical and observant poet has well observed, a limited existence changing into other elements is all that is permitted to the denizens of earth, whether of animal or vegetable birth—

> Whate'er of earth is form'd, to earth returns
> Dissolved; the various objects we behold,
> Plants, animals, the whole material mass
> Are ever changing, ever new!

And thus research may be continued and fresh knowledge gained while life lasts, and the great globe that we inhabit shall endure.

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A Spring "Fungus Foray" in the Whitfield Woods.

"Half-past ten sharp!" were the last words we remember hearing on Wednesday evening, the 13th of May, 1875; not an unreasonably early time, but yet, from some unexplained cause, we awoke at a very early hour the following morning, and there came over us dreamy visions of many exceedingly pleasant fungus forays made in the sombre autumnal months in the vicinity of Hereford,—incidentally occurred to us the choice species which either were sent to the Show, or were met with during the Excursions: then came the reminiscences of locality: the exact spots where such plants first met our eye: this naturally led us to meditate upon the kindness and hospitality of our friends, and if we were not loud in the protestation of our thanks, yet perhaps we felt all the more deeply how much we were indebted to them. In due time the appointed hour arrived, and we found ourselves, a party of six, on our way to Whitfield, discussing alternately the beauties of the landscape and numerous mycological questions, such as men coming from distant places, all working at the same subject, would naturally be only too eager to propound to their friends. The idea of a vernal raid in the Whitfield Woods was in itself somewhat a novel one, especially as the Club has up to the present confined itself almost entirely to the Autumnal Hymenomycetis. Reaching our destination about 11 o'clock, the first object which attracted our attention was a luxuriant growth of *Colchicum Autumnale*; the dark green leaves of which were searched in vain, however, for *Urocystis Colchici*, Tue. The party then proceeded to the Gardens, and viewed in passing, the Camellia House, where one or two specimens of *Pestalozzia Guepini*, Desm. were gathered. After admiring the *Salisburia* tree, which was just unfolding its peculiar cruciform leaves, the majority made for the wood walk: being without our leader, of course we missed our way, but what matters it in such a locality where mycological treasures abound at every step. On arriving at the open, the first find of cryptogamic interest was the *Ophioglossum*, the interest of which our Hereford friends seemed somewhat to undervalue, because it is so common in the district. On one of the fine old oaks were detected some splendid specimens of *Hysterium pulicare:* the minute elongated and black perithecia of which, nestling amongst the grey lichens, suggested to Barsoon its similarity to *Pulex irritans*. While gathering these, we were called by the Entomologist to witness a combat between a fine

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lusty honey bee and a spider, who had boldly taken the bee's head in his jaws in such an artistic manner (*secundum artem*—not South Kensington Art!) that his victim was unable either to defend or liberate itself. The mycologists now came upon a heap of dead leaves, which were as attentively examined and raked over as if they expected to come upon jewels of gold as in the fable. They were rewarded by finding *Stemonitis ovata*, P. and upon an adjoining stump, *Reticularia umbrina*, Fr. The remainder of the party now came up, bringing with them fine specimens of *Orthalium vaporarium* (Fr.). and lead the way to the wood walk. On the road Mr. Vize espied *Synchytrium Taraxaci*, De Bury, a species but recently added to our British Flora, which glows upon the living leaves of *Taraxacum*: shortly afterwards, *Æcidium violæ*, Schum. *Æc. ranunculacearum* D.C., *Urocystis pompholygodes*, Schlect. on Wood Anemone, *Uromyces ficariæ*, Lib. and *Peronospora pygmea*, Ung. were discovered. On a heap of half dry clay were observed numerous colonies of a brilliant orange Peziza, *P. Subhirsuta*, Schum., one of the *Humaria* group. Specimens of this were eagerly gathered for a forthcoming number of *Elvellacei Britannici*, in which publication doubtless they will be distributed to various parts of the European Continent. An old half dead Privet Bush next arrested the party, under which was found a specimen of *Peziza Acetabulum*, Linn., a species when well grown that bears considerable resemblance to a font. Its cup measuring about two inches across, of a sombre brown hue, is supported on a peculiar ribbed and lacunose white stem. The ribs branch at the top, and ramify upon the exterior of the cup, forming reticulations upon it. "This gives it," as Mr. Berkely observes, "the appearance of a cluster of pillars supporting a font with fret work between them." (*Eng. Flora, vol. v., p. 187*). Within a few inches of this were several specimens of the beautiful *Peziza livida*, Schum. To the Privet Bush itself, however, the Mycologists next turned their attention, and were quickly rewarded by finding *Tympanis ligustri*, Tue. This being a fungus of somewhat rare occurrence, two gentlemen proceeded to take a "good supply." For this purpose the twigs were cut into pieces about 18 inches in length, and tied by a cord into neat little faggots, which were carried with great care during the rest of the day. A few yards further a dead bush of Rosa canina furnished specimens of *Peziza rosæ*, Pors., growing upon a bright brown tomentose subiculum and also *Hysterium augustatum*, A. & S. Close by this rose bush was an oak stump covered with *Calicium curtum*, a very striking looking little lichen. But by far the richest treasures of the day were yet to be found. In a hollow, and upon an eminence, under the shade of some fine oaks, within an area of some 60 or 80 yards, the remaining time was spent: and here were gathered some of the rarest and most interesting Pezizæ our Flora contains, as well as several other species. The first find of any importance was *Polyporus rutilans*, Fr. on an oak branch. This plant is interesting on account of the rich carmine tint it assumes when treated with caustic potash—its natural colour being "tawny cinnamon." There is an excellent figure of it in *Mycological Illustrations*, t. 45, as well as of some ruby crystals of unknown composition which have been obtained from it. All fungologists know the vivid green which oak branches are sometimes stained by the mycelium of an *Helotium*: this is common enough

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in Autumn, but it is seldom the fully developed *Helotium* (*H. æruginosum*) is seen. We were however fortunate in finding several specimens of it in the assigerous state. The next find was *Corticium sanguineum*, Fr. on some old chips: this is a rare and very marked Corticium recognizable at a glance by its colour. On the same matrix was found *Sphæria ovina*, Pers and *Sp. innumera*, B. and Br. On the ground some magnificent specimens of *Ascobolus viridis*, Currey, were observed, and hard by several very large and well-grown plants of the rare *Peziza aurelia*, Pers. On the chips before mentioned a specimen of *Peziza cæsia*, Pers. was found. Within the space of a few minutes were gathered *Peziza virginia*, Butsch., *Ceratium hydnoides*, &c., &c. *Hysterium fraxini*, Pers., *Agaricus furfuraceus*, and *arvensis*, Schaff., *Lycogala epidendrum*, Fr., *Arcyria punicea*, P., *Trichia pyriformis*, Hoffim, and *turbinata*, With, *Sphæria pulvis pyrius* P., and *mammæformis* Pers., *Diatrype disciformis*, Fr., *Xylaria carpophila*, Fr. and *Hypoxylon serpens*, Fr. The time was now well nigh exhausted, and we were all beginning to feel the need of refreshment, when one of the party had the good fortune to light upon *Peziza candolleana*, Lib., a minute but exceedingly interesting Peziza, which grows from a Sclerotium (S. pustula), found in Autumn on oak leaves. The whole party now searched diligently for further specimens of this plant, and while doing so, Mr. Phillips was fortunate enough to light upon a magnificent plant of the rare *Peziza melastoma*, Sow. This was the climax of success: the cup nearly an inch across, of a black hue; dusted externally with powdered vermilion, and opening from an aggregation of long, black, rooting, filaments, what more could be desired as the termination of one of the most pleasant and successful fungus hunting days we remember. A hurried walk across the path in which Agaricus Gambosus was gathered, brought us to the house where lunch was waiting us. The drive to Hereford in the cool of the evening was magnificent, and loud were the Mycologists in their praises of the Whitfield Woods.

CHARLES B. PLOWRIGHT.

North Wootton,
17th May, 1875.

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ECCENTRICITIES IN THE OCCURRENCE OF FUNGI.

[Read by the Rev. J. E. Vize.]

The study of any special subject brings out astonishing, and, at the same time, very interesting facts. The *a priori* argument a beginner of Mycology would entertain with regard to the re-occurrence of fungi, might be that because a certain thing was found there it would happen there again; and that if he discovered it there by visiting the same spot, say one, two, three, four, five years afterwards, he would be tolerably sure to see it in the glory he first saw it. But experience teaches that an argument for the future, not based upon the past, is very apt to be erroneous in many very essential points. A very few years' work, possibly twelve months only, would damp the zeal and enthusiasm of him that has made certain that hereafter he shall have plenty of specimens wherewith to supply his friends, and have ample for himself. He will have discovered, to his cost, that although he has remembered the exact locality with the greatest nicety, and even if—as would be the case with fungi—he has found the "nourishing plant" in its correct place, yet the parasite is not there, and hence he is very possibly considerably disappointed. Probably every one of us has found this to be so. The case may readily be illustrated. *Podisoma juniperi* for three years has been in splendid condition in my churchyard upon two trees separated many yards from each other, but this year, although the substratum, in the shape of swellings and distortions, are manifest, not a single Podisoma has appeared, although I have been several times in the really favourable time to find it, namely, directly after a good deal of rain. The Puccinia on the Sweet William could not be found this year by Mr. Griffiths Morris in his locality, where it previously existed for several seasons, thus presenting a similar instance to the Podisoma just named. It was only last Saturday that I went to find the same plant growing on the Mœhringra. The time corresponded with that of last year, when it was abundant; this year there was not a vestige of the fungus to be found. *Œcidium Calthæ* was discovered last year, after the lapse of many years, by the Rev. J. Fergusson, in Scotland, who, at my request, searched vigorously for it. The *Œc. Statices* was never recorded until 1871 as British, with one exception, although known on the Continent. It was discovered in that year in several places, viz., Walney Island, Basingstoke, Hythe, &c. But its occurrence in 1871 was its best. In 1872 it had sadly degenerated, at all events at Walney Island, and this year it is scarce and inferior. What made it burst out so extensively and widely in 1871? It was eccentric to do so, and it is not likely to have been in England before, or some of our botanical friends would have seen it before. Then, look at *Puc. Malvacearum*, Mont. how fearfully it injured the Hollyhocks at Maidenhead and elsewhere in the summer of 1873. No previous notice was given of its arrival. No one expected it, and yet it became a scourge all at once, and sorely puzzled the brains of gardeners to know how to check its ravages. Cholera in the year 1831 was not more unexpected than *Puc. Malvacearum* in 1873, and yet many places were free

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from it. I lost no opportunity of searching for it, but it was not until the very end of last autumn that I discovered an infested leaf in my parish; that one leaf has thousands to follow it this year. I am told that in the places where this Puccina first appeared the disease has considerably abated. Now comes the question, how came the Puccina here at all? Why did it break out with such virulence? Why was it not universal in its attack? Time was necessary, and wind, too, for it to reach some places. Moreover, is it going to die out? *Puccinia Chrysosplenii* was recorded and figured by Dr. Greville in his Scottish cryptogamic Flora. Very great search was made for it by many persons anxious to find it. Since Dr. Greville's death no record of discovery is known until last year, when Dr. Buchanan White and myself found it—one near Perth, the other in Forden. Where was the plant all those years, and why should its reproduction be so far apart as Scotland and North Wales? Then look at the *Uredo Quercus*, Brond. As a rule it is decidedly scarce. A friend of mine, writing to me this week, says:—"*U. Quercus* has been glorious at Hollington, just when I was ill and could not go for it. The trees have been full of it, I could see that. It grieved me to look at them, and know what I had lost for you." Then see the eccentricity of *Peronospora Infestans*, Mont., how suddenly it broke out, and scattered the Irish far and wide through the world from the year of its attack until now. In the sister country it brought desolation, famine, death in its course, and would have done the same to us had we relied as much as the Irish did on the potato as an essential article of food. Then, if you think of your own work in the Woolhope Club you will most easily recall to mind instances in which you have been rewarded by the sudden discovery of specimens which were thought to be obsolete, and never likely to re-occur. Sowerby in his excellent work, figured *Thelephora Sowerbei*, Berk., and yet since his time until you found it there was no one fortunate enough to see a living British plant of it since the days of Sowerby. Without a doubt fungi do appear, then disappear for a time to re-appear once more. The reasons for these fluctuations are various. They may be caused partly by changes in the seasons, some being much more favourable than others for certain specialities. This may arise from want of workers among the fungi, or be caused from deficient records as to *habitats*. In some cases they may have been seen, but passed by from want of recognition. Of one thing I think we may be tolerably certain, that the system of the Almighty is not to create them, then to destroy them that they may be created afresh within a few years. The germ exists in the nycelum, or the spore, and will, according to the law which guides its reproduction, spring up again, to gladden ourselves, perhaps, and future students.

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REPRODUCTION IN THE MUSHROOM TRIBE,

(COPRINUS RADIATUS, FR.)

BY MR. WORTHINGTON G. SMITH, F.L.S., &c.

For the purposes of minute reasearch into the vital phenomena of the Mushroom tribe, Coprinus radiatus, Fr., possesses many advantages over the other species of the large order to which it belongs. The first great advantage peculiar to C. radiatus is that it grows readily and abundantly on dungheaps from April to December, and it comes up equally well in town and country. The second point in its favour is that it is so small and transparent that every part can be quickly examined, and an entire plant kept under the covering glass of the microscope. The third advantage found in C. radiatus rests in the fact of its whole life being so exceedingly short, that its entire vital functions are performed in a few days. Having these points in view I have, during the whole of the present summer and autumn, kept up a large bed of fresh horse-dung in my garden, and from this bed I have narrowly watched the growth of many generations of the plant I am about to describe.

A complaint is often made by persons unused to the microscope, and to the appearances of objects as seen by its aid, that it is impossible to see the real objects as they are represented in drawings. To a certain extent this is borne out by facts, for a drawing is never meant to represent what may be accidentally seen at one sitting, but is designed as a summing-up of all that has been seen during many hundreds of sittings. Anyone looking for the first time through a good telescope at Jupiter's moons, Saturn's ring, or the planet Mars, might be a little disappointed in the apparent smallness and lack of strongly marked outlines in the objects seen; but this does not detract from the correctness of astronomical diagrams, which are only matured after many patient observations. No one expects to see the solar system as shown in a model, or the country as seen on a map.

It may reasonably be premised that the facts observed in connection with the life history of Coprinus radiatus will more or less apply to all the other species belonging to the Mushroom tribe; but it would be impossible to make the observations here recorded on the more fleshy species, because, instead of days, these latter plants take months to mature. In C. radiatus generation after generation keeps springing up in almost daily succession, but in the more fleshy species, exclusive of Coprinus and Bolbitius, I am convinced there is, as a rule, but one generation in the year. The common Agarics of the autumn spring up from the mycelium formed during the fall of the previous year, and this mycelium has rested in the ground for twelve months. In digging up old pasture ground, or the dead leaves of an autumn which has passed, mycelium in a resting state is invariably found. There is no such long rest with the mycelium of Coprinus radiatus, for so long as the weather is not too dry, too wet, or too

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cold, the fungus goes on perfecting itself day after day without ceasing. During hot, very wet, or frosty weather the spawn lies buried, and it rests in the warm, moist dung for short periods of time only.

Coprinus radiatus, Fr., is one of the dung-borne Agarics with a cap which measures from an eighth to one quarter of an inch in diameter, and this filmy pileus is supported on a stem, which on an average measures from a quarter to three-eighths of an inch or more in height. (Plates I, and II.) The whole cap is a mere transparent film, and the fragile stem is like an atom of gossamer thread. A breath will totally break down and collapse every part of the plant, whilst a heavy dew or slight shower of rain will destroy a whole colony. These minute Agarics can only be gathered with the aid of small forceps, for if they are taken in the fingers they at once collapse, become liquid and vanish. So little moisture does a single specimen contain that it is lost in the moment or two consumed in taking it for examination from the garden to the house. The young plants may generally be seen dotted over the dung, like in size to so many pins' heads (Plate I., B), and from this, the infant state, to maturity, the growth of the fungus is very rapid. At seven or eight in the evening nothing but immature plants can be seen (Plate I. C, D, enlarged 20 diameters) ; about eleven or twelve a rapid growth commences, and by two or three o'clock in the morning perfect maturity is reached. If the morning is moist the plants will remain in perfection till nine or ten o'clock, but if it is dry they will not last after five or six. On shady roadsides or in dark places the time required for growth may probably be a little more or less, but the present observations apply to the plants as found growing on dung in a light and open place. To get a good view of C. radiatus it is necessary to magnify it at least from 50 to 100 diameters ; the nature of the stem and gills can then be made out, and all the individual component cells be clearly seen.

Mature plants are figured at E, F (Plate I.,) enlarged 10 and 20 diameters, the first showing the nature of the outer surface of pileus, with its furrows, and the other the lower or fruiting surface, with the nature of the gills, and the collar formed by them near the insertion of the stem. At G is shown the relative number of the basidia or privileged cells, which carry the naked spores, and at H the relative number and position of other privileged cells, termed cystidia. To these latter bodies I shall presently refer more fully, and they are merely adverted to here that some idea may be formed of their great number. At I is shown a transverse section through the cap of the fungus, a short time before expansion (when the umbrella-like top is down), to show that the hair-like stem is hollow, and that the plant in infancy is enveloped in a complete veil or bag, the presence of which is shown by the ring of cells and hairs which forms the circumference of the diagram.

For a proper comprehension, however, of this minute fungus much more than a superficial examination is necessary, and the first thing to be done in the way of dissection is to secure a good longitudinal section of the fungus from top to bottom, as shown in Plate II (J)—this enlarged 35 diameters, at once shows the

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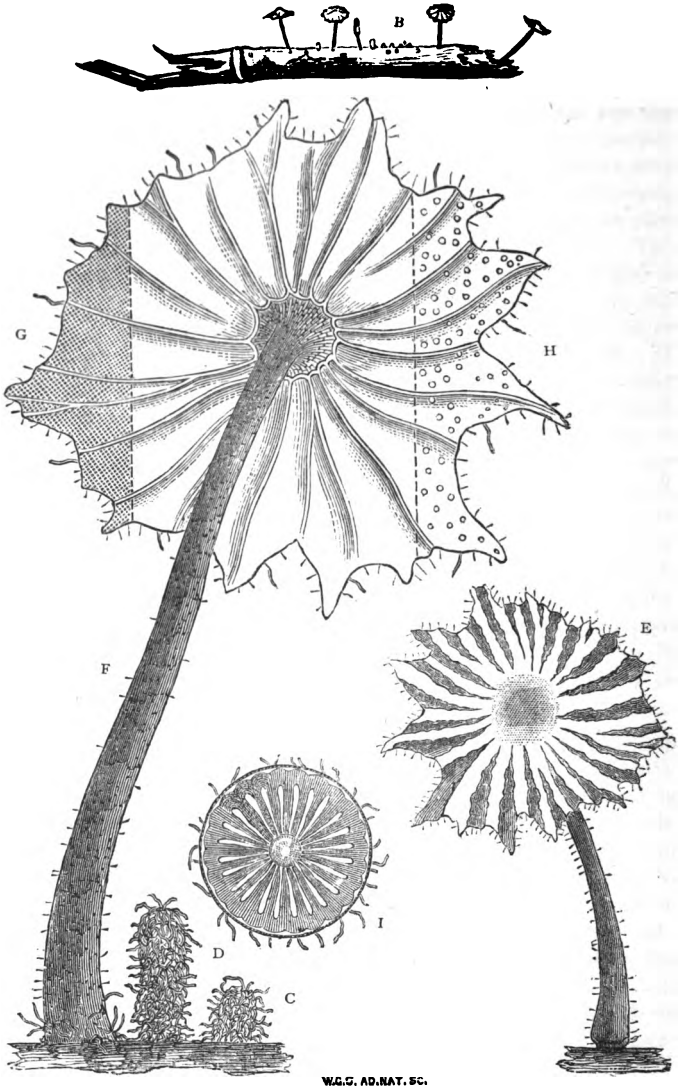
Plate I.



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REPRODUCTION OF COPRINUS RADIATUS, Fr.

PLATE I.

A. Coprinus radiatus, natural size, on a bit of straw.

B. ,, ,, ,, young plants.

C. Young plant enlarged 20 diameters.

D. ,, ,, ,, 20 ,,

E. Mature plant ,, 10 ,,

F. ,, ,, ,, 20 ,,

G. Shows the relative number of Basidia.

H. ,, ,, ,, of Cystidia.

I. Transverse section of cap of fungus just before expansion, enlarged 20 diameters.

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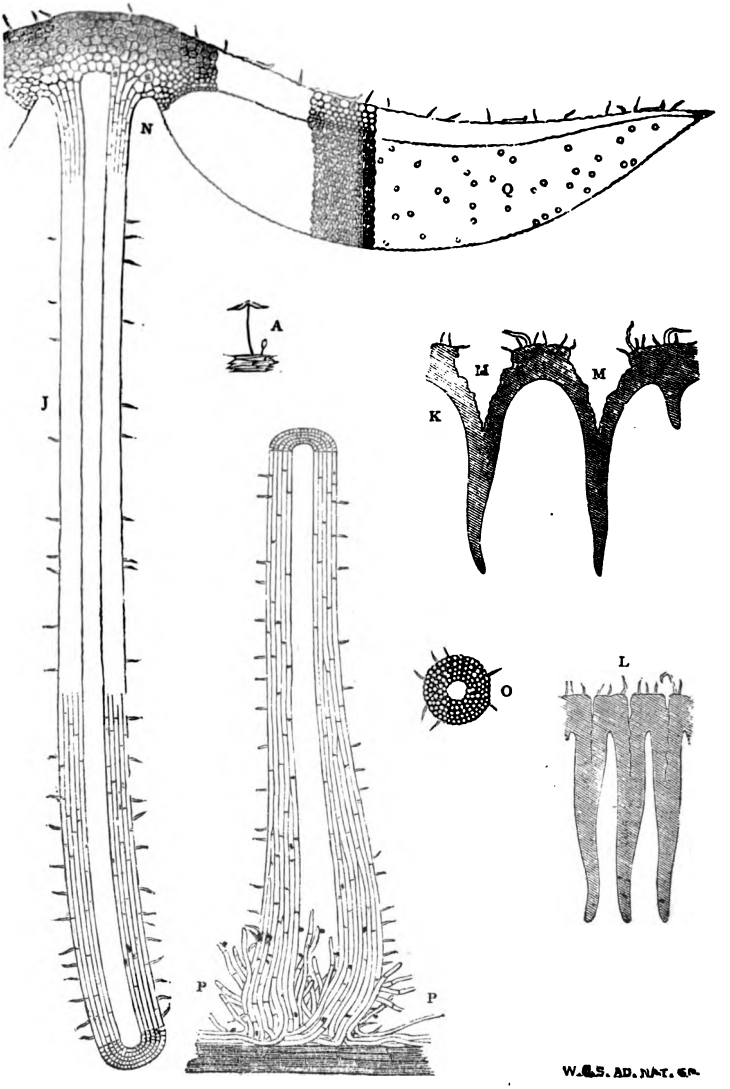
PLATE II.



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REPRODUCTION OF COPRINUS RADIATUS, Fr.

PLATE II.

J. Longitudinal section, enlarged 35 diameters.

A. Longitudinal section, natural size.

K. Vertical section across gills after expansion.

L. Vertical section across gills before expansion.

M. Cracks due to expansion of fungus giving plicato-radiate appearance to upper surface.

N. Gills free.

O. Stem hollow.

P. Hairs which are remains of veil.

K to P enlarged 50 diameters.

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immense number of cells which go to make up one of the fugitive little plants belonging to Coprinus radiatus. By reference to the figure it will be seen that the stratum of flesh which forms the pileus is only six or seven cells in thickness, and the external surface is covered with a few hairs of different sizes (the remnants of the universal veil or wrapper), some of the smaller hairs being tipped with a gland. Another good vertical segmental section across the cap and gills will show the appearance of the plicato-radiate outer surface of the pileus to be caused by a series of cracks which are brought about by the necessary sudden expansion of the cap, which act of expansion tears (in these positions) the component cells of the pileus apart, Plate I, E, and Plate II, K. A transverse section through the fungus when in an infant state shows the commencement of these fissures, as at Plate I, I, and Plate II, L. The gills have no trace of a trama—the so-called trama being the cells which form the substance between the hymenium in the gills; if present this substance would be at M M, Plate II, but one of the characters of the genus Coprinus is that the gills have no distinct intermediate substance in the gills. In the plant under examination the lamellæ or gills are free from, and form a collar round the stem (Plate II, N), and are only about seven cells in thickness.

Good sections down and across this stem when young will show it (gossamer like as it is) to be piped or hollow from top to bottom (Plate II, O), and the hairs seen at the base (P P) are the torn remains of the veil or wrapper which once held the edge of the pileus (Q) down to the base of the stem. In this figure several spores may be seen at the base, carried up amongst the cells of the stem. On looking at an entire plant of C. radiatus in this way under a low power of the microscope it appears to be formed of a few thousands of cells only, but if these cells are now measured and counted, which is by no means a difficult matter, it will be found that instead of thousands it really requires millions of individual cells to build up one of these minute plants which a breath destroys. The smallness and lightness of one fungus is such that it requires 150 specimens to weigh a grain, or 72,000 to weigh an ounce troy. In the type specimen of C radiatus now figured there were 22,560,000 cells in its structure irrespective of the spores, which numbered about 3,200,000 more. If all these cells and spores are only equivalent to the hundred-and-fiftieth part of a grain, it follows that in an ounce of fungus cells there must be no less than one billion six hundred and twenty four thousand millions of these bodies, exclusive of the spores. In a large Mushroom the cells would number hundreds of billions. Still more wonderful is the fact that each individual cell is furnished with a spark of life, contains water, protoplasm, and other material, and is capable of growth and assimilation.

The purpose of this essay is to demonstrate something of the life history of the minute but truly wonderful fungus now before us; and with this object in view it is not only necessary to use the higher powers of the microscope, but to patiently watch the fungus and its changes at every hour (almost minute) of the night and day and for several days in succession.

In the vertical section of one of the minute gills, as shown in Plate III, magnified 150 diameters, the whole fruiting and reproductive surface of the fungus

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is seen at a glance. The nature of the furrows in the pileus (R) is now perfectly clear, every cell being seen in position, and the remnants of the universal veil or wrapper are seen on the surface of pileus at S. Studded amongst the cells of the upper stratum of cap may be seen various brilliant crystals which belong to the ammonio-phosphate of magnesia, and which crystals are taken up by the fungus from the manure on which it grows. Many dung-borne Agarics are covered with so-called micaceous particles, which, in many instances, doubtlessly arise from the manure which supports the fungus. It is a matter of considerable difficulty to get a section like this, for if attempted clumsily no result will follow beyond a slight discoloration of the edge of the lancet; it is necessary to take the slice at the exact moment of maturity, and even then it requires the perfection of dexterity to cut the fungus properly, as the plant is sticky in all its parts. A fragment of the fruiting surface of a gill is shown at T.

To understand the vital phenomena of C radiatus it is necessary to comprehend the meaning of the bodies seen in Plate III. and IV. The whole fungus is built up of cells, which run parallel with each other (and at maturity are very long) in the stem (Plate II), and which spread laterally, and then become more or less spherical in the pileus. When these cells reach the gills or fruit-bearing surface (hymenium, U U), a certain differentiation takes place in their functions. The majority of the cells remain simple, but certain other cells which are spread over the gills with the greatest regularity assume a different nature, and produce spores. These cells are called basidia (meaning small pedestals, V V, Plate III and IV), and the spores, or analogues of ovules or seeds, basidio-spores, because they are carried on these little pedestals. The minute threads between the spores and their pedestals are termed spicules or sterigmata (literally props). Certain other privileged cells (W W, Plate III) are termed cystidia (bladders), and around these latter organs and their meaning the principle interest of the subject in hand will now centre. But let it be borne in mind as a preliminary fact of the utmost importance that at first the fungus is composed wholly of simple cells which show no differentiation; no differentiation in the cells is seen in infancy when the gills are first formed, but the privileged cells, known as basidia and cystidia, come only into existence and that simultaneously as the plants reach maturity. This differentiation I consider to be sexual, the basidia being female, and the cystidia the male organs. When the contents of the basidia and cystidia are interchanged, the result is a return to another series of cells, which go to form a new plant. I am perfectly aware of the opinions which have been expressed by other botanists (and to which I shall return), but it is not so much my aim to make my observations accord with what others have said, as to record what I have seen myself, and to give my own interpretations of the phenomena seen, irrespective of what has been said or done before.

The first sign of differentiation in the simple cells of the gills, when the basidia and cystidia are about to be produced, is in the privileged cells becoming glossy, crystalline, and translucent: they both appear to secrete a material which makes them conspicuously brilliant. Each basidium then throws out four slender

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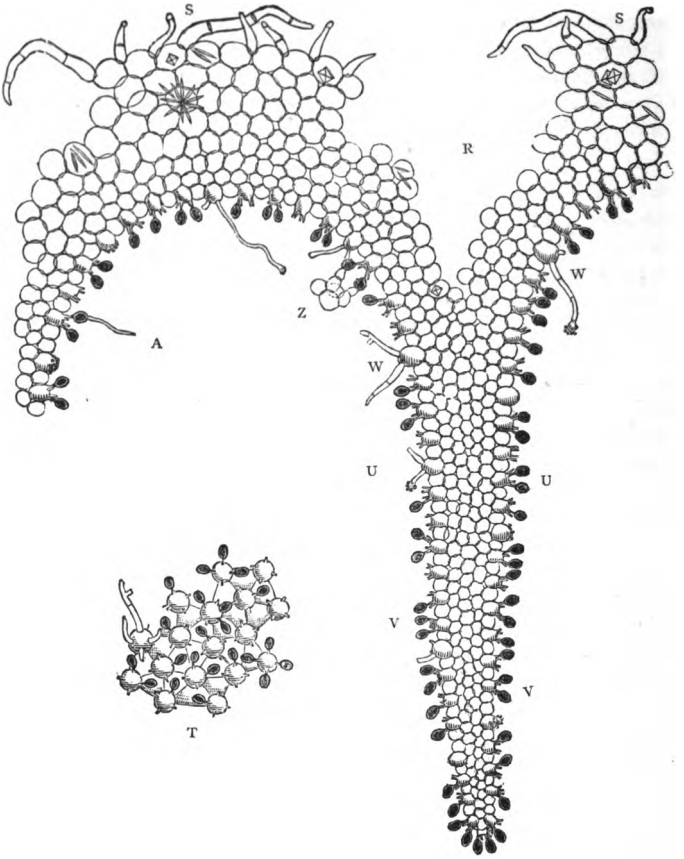
Plate III.



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REPRODUCTION OF COPRINUS RADIATUS, Fr.

PLATE III.

Vertical Section of surface of Gill, enlarged 150 diameters.

R. Furrow of pileus formed by cracking in expansion of fungus.

S. Remains of universal veil or wrapper.

T. Fragment of fruiting surface of gill or hymenium.

U. Section of Hymenium.

V. Basidia.

W. Cystidia.

Z. Spores germinating.

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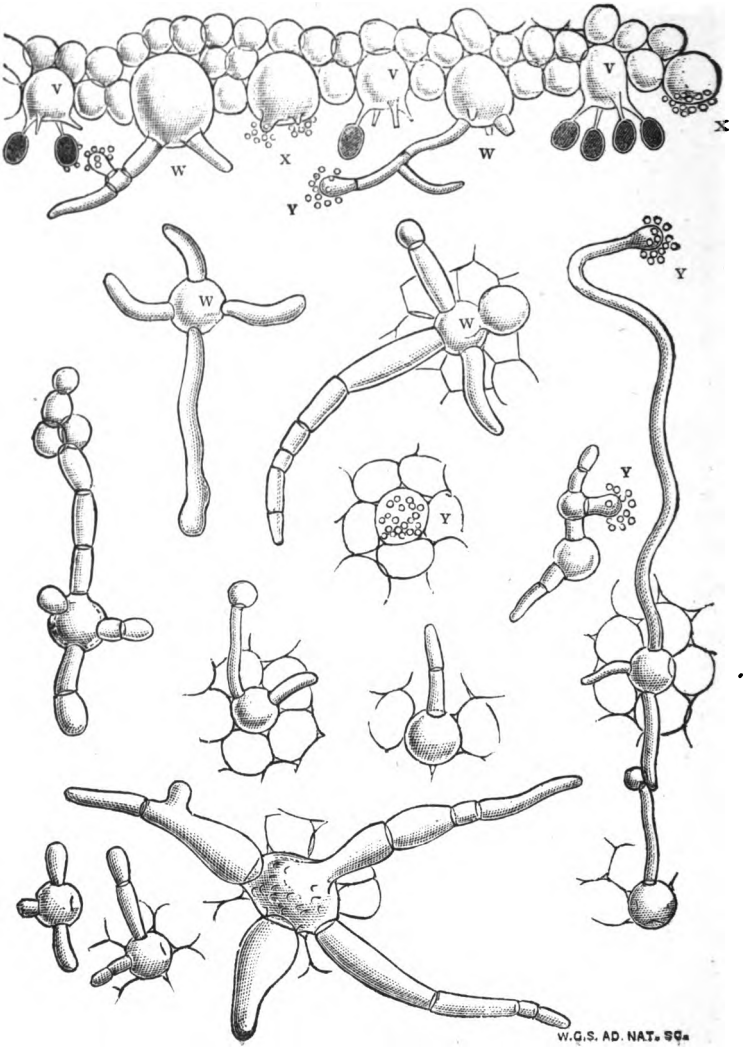
Plate IV.



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REPRODUCTION OF COPRINUS RADIATUS, Fr.

PLATE IV.

Portion of Hymenium at top of plate.

V. Basidia.

W. Cystidia.

X.Y. Spermatozoids.

Lower portion of plate various germinating cystidia, all figures enlarged 350 diameters.

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branches, the tips of which gradually swell and form spores. The cystidia (W) are more sparingly produced (for their number in this species see Plate I, H, and Plate II, Q), and at first cannot be distinguished from the basidia, though they are frequently larger in size; they are commonly granular within, and are in many species, as in the one before us, crowned with granules, W (Plate IV, X), but sometimes they bear four spicules, and this latter condition has led some botanists to consider the cystidia to be barren basidia, but that they are really cystidia with spicules is proved by the following fact, which I believe to be somewhat new. In moisture, as supplied by the expressed juice of horse-dung (or even distilled water) these spicule-bearing cystidia germinate at the four points of the spicules, and produce long threads, which bear at their tips the granules so frequent in typical cystidia (Plate IV Y). The cystidia are moreover furnished with spicules in the subgenus Pluteus. The germinating cystidia are seen in several places at W, Plate III and IV, and the granules at X, Y. On the top of Plate IV is seen a section of a gill with all the bodies in position enlarged 350 diameters, whilst on the lower part of the cut may be seen various germinating cystidia to the same scale as seen on the surface of a gill. The granules at Y, which are at first not capable of movement, are really spermatozoids possessed of a fecundative power, but to see this power brought into operation considerable care and patience and the higher powers of the microscope are requisite. In certain other of the Agaricini, the protoplasmic contents of the cystidia are at times discharged from one mouth only and that at the apex of the cystidium.

Before quitting Plates III and IV, I may say that when a slice, as represented in Plate III, is placed under a covering glass in a drop of water, all the cells totally collapse and perish, so that in three or four hours not a vestige remains, but the same drop of water which destroys the old cells instils life into the granules or spermatozoids, which after the lapse of a couple of hours begin to revolve, and ultimately swim about with great rapidity. These spermatozoids attach themselves to the spores, pierce the coat, and discharge their contents into the substance of the spore. From twenty-four to forty-eight hours after this the spore discharges a cell which soon becomes free, and this is the first cell of the pileus of a new plant which rapidly produces others of a like nature (Z Plate III). Now the same water which had the effect of immediately collapsing and destroying the old cells, has quite a different effect on the new cells as discharged from the fecundated spore, for the whole development of the new plant depends upon the constant presence of moisture, expressed juice of horse-dung being perhaps best. A spore unpierced by the spermatozoids is shown producing a mycelium peculiar to itself, at A, Plate III.

A spore is commonly considered to have some analogy with a seed, but according to my views its analogy is rather with an unfecundated naked ovule without an embryo, unless the nucleus within the spore may in some way represent the rudimentary fungus; when the spores are formed within sacs or asci, the ascus bears some analogy with the ovary. The cystidium, on the other hand, represents with its granules the anther and its pollen.

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The six spores represented on the top of Plate V. are magnified 1000 diameters, and each viscid spore, which is furnished with a nucleus lighter in colour, but with a dark outline, has been pierced and fertilised by one or more spermatozoids, whilst the unfertilised spore at A has burst at both ends, and produced a mycelium of its own. At B may be seen three spermatozoids which have burst after twelve hours in expressed juice of horse-dung, and which have also produced branching threads peculiar to themselves, reminding one of a pollen tube. It is quite possible that these latter threads may help to produce a new plant if they come in contact with the spores. The large figure at C is similar in nature to the group at Z (Plate III.), and represents three fertilised spores which have burst and produced the first minute knot or group of cells of the cap of a new fungus. These eighteen cells took four days for their production, and the crystals belong to the expressed juice of the horse-dung in which they grew. The spermatozoids as here shown begin gradually to revolve after being kept in liquid for two hours, and the movements last for at least four days. At first these bodies are perfectly spherical, as at D, when they merely oscillate, then they revolve slowly, and as time goes on, a single turn of a spiral makes itself visible, and the bodies whirl round with great rapidity. At intervals the motion entirely ceases, and then, after a short lapse of time, the gyration is again continued.

Judging from the presence of the eddy round these bodies whilst whirling (E E, Plate V.) they are possibly provided with cilia, but from the extreme minuteness of the bodies themselves I have not been able to satisfactorily demonstrate their presence. The whirling of the spermatozoids is sometimes so strong that when they attach themselves to the spores they twist them round after the manner of the revolving oosphere in Fucus.

When the cells of the old parent fungus collapse and disappear in the water, their place is in less than two hours occupied by innumerable quantities of bacteria, vibriones and monads, which belong to the infusoria. In these two hours every cell of the pileus has generally vanished. Where these infusoria come from, or how they so speedily come into being, is difficult to say. They may possibly be present in a latent state in the juices of the fungus, but I have invariably found, when a single specimen of C. radiatus has been placed on a slide under a covering glass with a drop of water, and this, again, under a propagating glass, that as the millions of fungus cells quickly disappear, so millions of simple infusoria just as quickly come into being. It seems almost reasonable to believe that the fungus cells themselves become suddenly transformed, and reappear as simple infusoria; the change would not be quicker or more remarkable than the rapid production of the purple-black spores from the crystalline and colourless basidia.

Be this as it may I have here engraved the abundant infusoria to the same scale as the cells. The tailless monads at F have a rocking Brownian movement, whilst those with tails, G, propel themselves rapidly about after the manner of minute tadpoles. These monads are liable (without care) to be mistaken for

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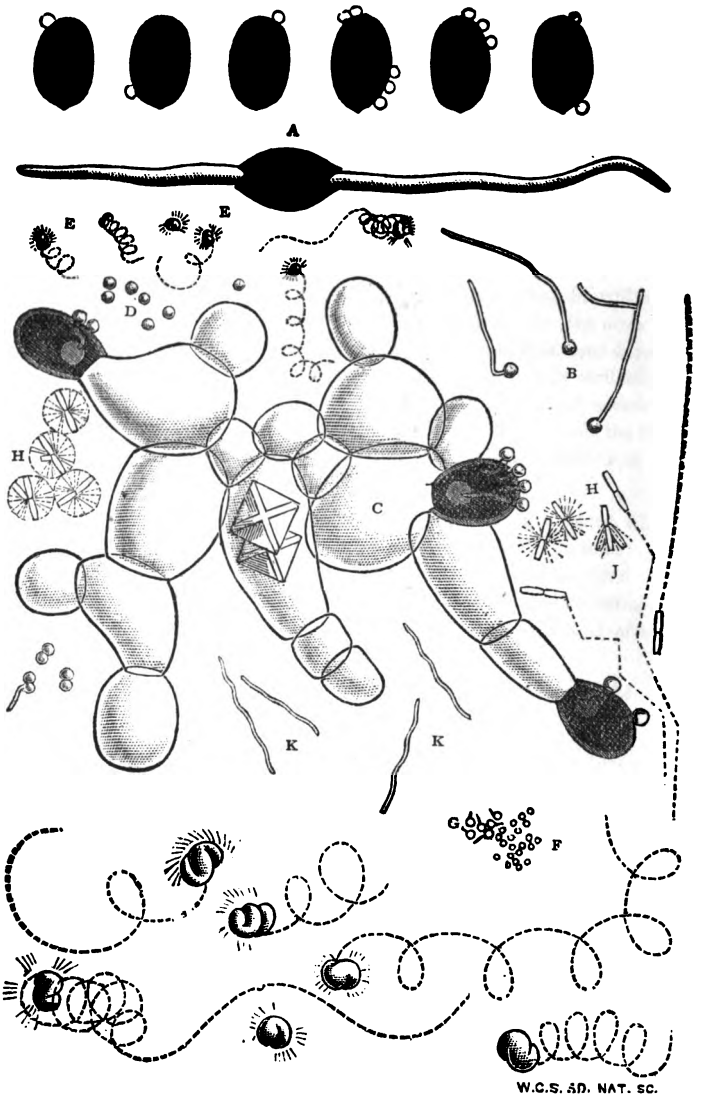
PLATE V.



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REPRODUCTION OF COPRINUS RADIATUS, Fr.

PLATE V.

Spores and infant plant (and infusoria) enlarged 1000 diameters.

Fertilized spores at top.

A. Unfertilized spore producing mycelium threads.

B. Spermatozoids producing pollen-tube-like threads.

C. Similar to Z, Plate III., three fertilised spores producing first cells of cap of a new fungus.

D. Spermatozoids in first or spherical state.

E. Spermatozoids rotating as after a time they do.

F.	Infusoria.	Tailless monads.
G.		Monads with one cilia or tail.
H.		Bacteria movements indicated by dotted lines.
J.		,, ,, ,,
K.		Vibriones.

In lower part of plate Spermatozoids enlarged 3000 diameters, dotted lines indicating movements.

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the bodies I refer to spermatozoids, from which they are, however, very different. The bacteria are represented at H H, with their various movements (indicated by dotted lines), either straight, zig-zag, or rapidly revolving on a central axis; when they so revolve they cause a miniature vortex amongst the monads and atoms. I have commonly seen one segment move from side to side, as at J, whilst the other segment remained quiescent. I have also seen them bud from the centre, and occasionally they occur with three limbs instead of two, radiating from the central axis. The vibriones are like vegetable screws, and are shown at K. The spores and infusoria neither collapse nor burst in boiling. As for the monads, vibriones, and bacteria, it can hardly be admitted that they are generated spontaneously from inorganic materials; my experiments rather point in the direction that they are only differentiated forms of already living cells. However this may be, my boiling has not destroyed either vitality or form, and those interested in the subject of spontaneous generation may possibly read the result of the following experiment with interest. A dozen semi-decayed specimens of C. radiatus, swarming with minute infusoria, were boiled in a test tube for five minutes and then hermetically sealed at the highest point of ebullition. At the end of a month the tube was opened and a drop of its liquid contents at once placed under a cover glass of the microscope for examination. Spores, cells, monads, bacteria, and vibriones were all there, but the latter motionless and apparently dead. In fifteen minutes however they showed signs of life, and began to slightly move about, in thirty minutes the movements were decided in nearly every specimen seen, whilst in sixty minutes the infusoria darted about with almost the same energy as they did before they were boiled. For a better appreciation of the exact form and gyrations of the spermatozoids they are shown again at the bottom of plate V., enlarged 3000 diameters. At first it requires long and patient observation to make out the form of these bodies satisfactorily, but when the peculiar shape is once comprehended there is little difficulty in correctly seeing their characteristic form. The difficulty is something like that experienced by beginners in separating very small and close double stars with a telescope; at first and sometimes for a long period only one star can be seen, till quite suddenly the two are made out, and they are seen as two ever afterwards.

It is not uncommon to find the spores of other dung-borne fungi sticking to the specimens of C. radiatus, and it is quite frequent to find not only the spores but the perfect asci of certain species of Ascobolus sticking to the under surface, to which position they have been projected from the plants of Ascobolus growing on the dung. I have also seen the eggs of various mites, nematoid worms, &c., carried up amongst the cells which quite accounts for larvæ being found within the substance of apparently sound fungi.

In the works I am acquainted with there is no mention of the cystidia falling bodily out of the hymenium on to the ground, yet this is the case in several Agarics I have examined, and is so with C. radiatus. The spores naturally fall to the earth, and with them the cystidia, and it is upon the moist earth that fertilisation is generally carried out. All botanists will remember Hoffmann's

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observations, where he has indicated the passage of basidia into cystidia, and his remarks on the upper surface of the ring which grows round the middle of the stem in Agaricus muscarius. In this latter position Hoffmann found a quantity of gelatinous knots, from which projected one or more oscillating threads, terminated frequently with a little head, which occasionally becomes detached. My interpretation of these observations is, that Hoffmann lighted upon the fallen cystidia on the upper surface of the ring, where they were throwing out threads. Hedwig made somewhat similar observations on the ring in Agaricus.

From the condition of the infant plant, as figured on the hymenium, plate I. z, and plate V. c, it is easy to trace the young fungus through the various stages of its growth, as seen at plate VI., where the figures are all enlarged 500 diameters, the lower group of cells shows a plant of seven days' growth in the expressed juice of horse-dung. In all these figures it will be seen that crystals and spores are carried up by the cells, and the lower figure conclusively shows that the first cells of the new plant are the large ones which belong to the pileus; indeed the hairs of the pileus as here shown are amongst the earliest cells produced, these hairs and the threads of the mycelium (which is always highly granular near the plant) are almost one and the same in character. In plate VI. and in plate VII. the infant fungus resembles a Puff-ball, to which it indeed bears a certain natural relationship. The whole plant in infancy is enveloped in a wrapper of cells the fructification being entirely concealed within. In the lower figure on plate VI. may be seen two spermatozoids which have burst, and K K K shows the cells of straw.

When the fungus has made about the number of cells represented on the bottom of plate VI. the growth cannot be carried any further beneath a covering glass. Plate VII. represents on one side the elevation, and on the other the section of the very smallest infant plant it is possible to see with a lens on the dung. The fungus represented is magnified 200 diameters, and the original was about half the size of a pin's head (see A A A sketch in margin). The nature of the hairy coating, which forms the veil and the cells which are to form the future gills, are here clearly seen. This figure shows the fungus in its Puff-ball condition at the time when the cells are being actively produced. It contains only a small proportion of the actual cells which go to make up a perfect fungus, and represents probably a full week's growth from the spores. How it is the cells have an inherent property of building themselves up into a particular design, no one knows any more than it is known how the fine spark of life is kept up in these cells from one generation to another.

The mycelium now grows in a radiate manner from the base of the young plant, just as a germinating seed throws up a plumule and throws down a radicle. This mycelium being the produce of fertilisation is now capable, under certain conditions, of producing new plants on certain spots on the threads. Spores are now unnecessary, in the same way as fresh seeds are unnecessary where the creeping root-stock of Couch-grass is present. Or the mycelium may go to rest in the form of cords or thick threads, when it is termed Rhizomorpha, or in the form of knots

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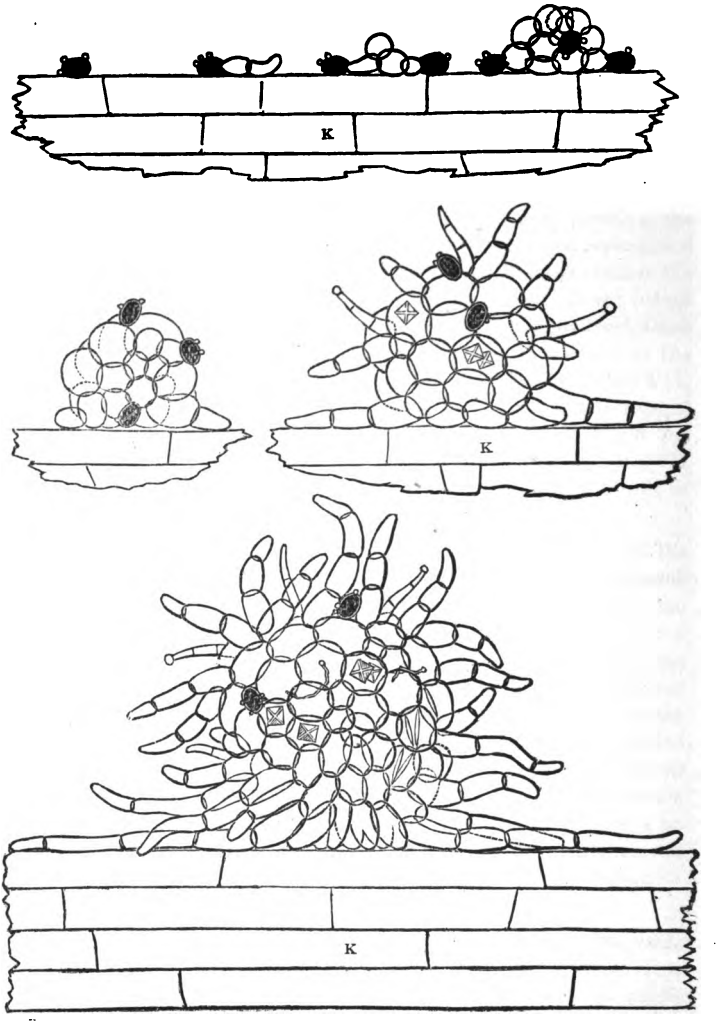
PLATE VI.



W.C.E. AD. NAT. SC.

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REPRODUCTION OF COPRINUS RADIATUS, Fr.

PLATE VI.

Young plants as grown from spores, enlarged 500 diameters. K, cells of straw. The lower plant is of about 7 days growth.

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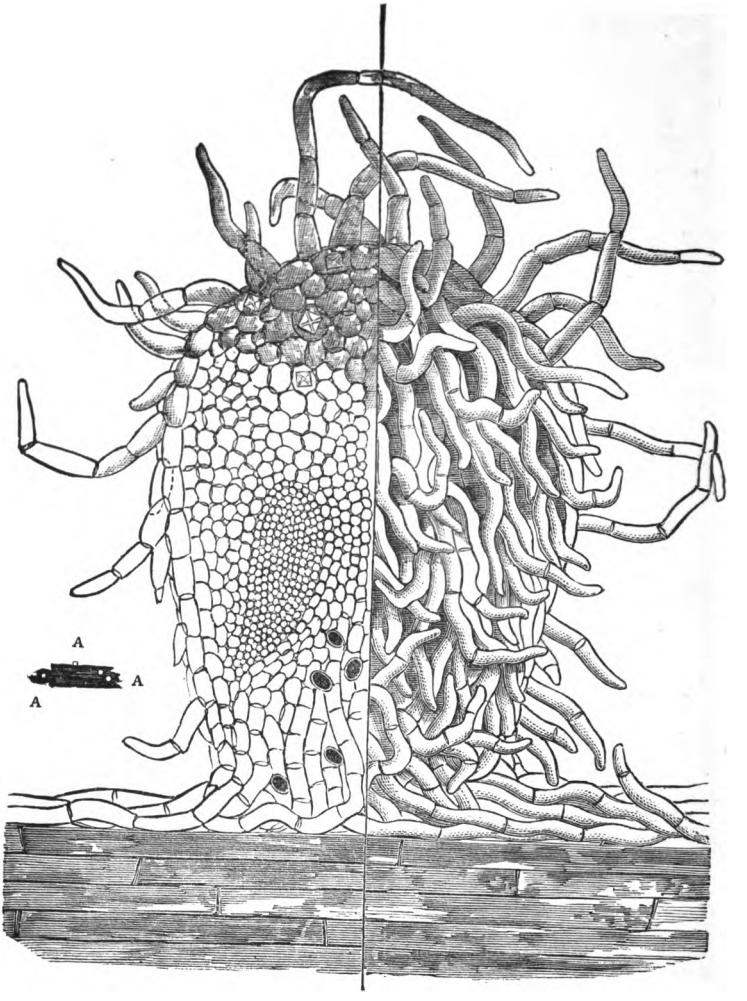
PLATE VII.



W.G.S. AD. NAT. SC.

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REPRODUCTION OF COPRINUS RADIATUS, Fr.

PLATE VII.

Young plant grown from spores, on right side elevation, on left section, 200 diameters.

A. Natural size.

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or bulbets, when it is called Sclerotia. A similar state of things is common in many perennial flowering plants, as Convolvulus sepium and Sagittaria sagittifolia, and they both at first arise from a seed in the same way as a Mushroom arises from a spore. In Mushroom-spawn the grower gets a material similar in nature to the root-stock in Couch-grass.

Plate VIII., and last represents, enlarged 120 diameters, C. radiatus a few moments before expansion, when nearly all the cells are present. Most of the cells here shown are, however, only about one-half the size they reach at maturity, and they are not all and every one produced till the exact moment of complete expansion, as I have ascertained by counting the cells of many specimens. This is not to be wondered at, for if the 22,500,000 cells which go to make up one of these minute plants require fourteen days for their production, it follows as a necessity that the cells go on multiplying all the fortnight, night and day, at the rate of 1,114 to the minute. It takes about five hours for the spores to be gradually produced all over the hymenium—say from 5 to 10 o'clock in the morning, and as there are upwards of 3,000,000 spores to each plant, they as a consequence gradually appear upon the basidia or spore-bearing spicules at the rate of 100,000 every minute.

No sooner has the plant arrived at perfection than that very moment it begins to perish. I have demonstrated that the cells of the pileus and the hairs which form the veil are the first to appear, and so they are the first to disappear. The fine matted hairs which form the veil in plate VIII., B B B, are all torn asunder during the few moments consumed in the expansion of the cap, and at the moment of maturity the hairs vanish and the pileus is naked, nakedness is the first sign of its decay. When the fragile little fungus has at length produced its fruit, and is prostrate and dying upon the matrix from which it sprang, then, as can be seen with patience under the microscope, the cystidia produce spermatozoids which are at first passive and then active; these pierce the spores and cause the discharge of the first living cell of the pileus of a new plant. It will be seen from these observations that C. radiatus, though one of the most minute and fugitive of all the Mushroom tribe, is yet as completely perfect in all its parts as any of the larger and higher species of Agaricus. It must not be supposed that these observations can be followed without close attention and the utmost patience. All the 3,000,000 spores of the fungus do not grow and make new plants, or the world would soon be covered with C. radiatus. For every spore that is fertilised and grows there are millions which necessarily perish.

On a dung-heap which will produce C. radiatus, other species, as C. nycthemerus, &c., are sure to appear; and not only do allied species come up in company with C. radiatus, but every intermediate form between one and the other may be gathered any morning. These latter plants belong to no species described as such, but are natural hybrids, doubtlessly produced by the spermatozoids of one plant piercing the spores of another. Amongst the larger species of Agaricus similar forms are quite common, and they prove sore puzzles for those men who only want *names* for the fungi they find. I am convinced that at least three-fourths of the described

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species of the higher fungi have no claim to rank as true species, and that plants like Agaricus procerus, A. rachodes, A. excoriatus, A. gracilentus, with others, are mere forms of one and the same plant with every intermediate link.

Van Tieghem has recently been working on this species, and he has arrived at the conclusion that the fungus produces spores of different sexes. But to me it is quite unreasonable to imagine seeds or spores to be of different sexes. Known facts point quite in the opposite direction, and if sex is once allowed in seeds and spores then we must be prepared to allow sex in pollen and spermatozoids. A spore or ovule must be considered female, whilst unfecundated or still in the ovary, but when once fertilised it combines both sexes and cannot be other than hermaphrodite. A secondary colour, as orange (which combines the red and yellow primaries), can never be red or yellow. In dicœcious plants the seeds are capable of producing either sex, and are not themselves male or female, and even the great fleshy rootstock of Bryonia dioica will be male, in one place, and if removed to a different position be female. The Rev. M. J. Berkeley, writing of Coprinus (*Gardeners' Chronicle*, April 17, 1875, p. 503), says —"Late examinations of the spores of some Coprinus under germination seem to show that impregnation takes place at a very early period."

Now my observations show that this impregnation often actually takes place on the hymenium itself, the product being a single cell, which in the species now described rapidly developes into a new individual. The spore and spermatozoid may be considered as somewhat analogous with an ovule and a pollen grain, or with what is seen in Chara; or like the escaped oosphere and spermatozoids in Fucus amongst the Algæ.

I cannot attach much importance to Œrsted's interesting paper on the fructification of the Agaricini. His notes are on Agaricus variabilis, a plant he gathered from a Mushroom bed. Now, as far as my experience goes, A. variabilis, is peculiar to dead stems, sticks, and leaves, and does not grow upon dung. Moreover Œrsted experimented upon threads of mycelium taken from dung, and presumed only to belong to this Agaricus; but this mycelium was quite as likely, in my opinion, to have belonged to fifty other things. De Bary, speaking of Œrsted's observations says—"It is impossible not to perceive the similitude between the phenomena seen by M. Œersted and those I have described in Peziza confluens." It is quite doubtful whether or not Œrsted had got the mycelium of some dung-borne Peziza for his experiments, as P. vesiculosa, which is always present on dung-heaps.

In the observation of natural phenomena it is never well to follow, without thought and original observation, in the footsteps of others. In the case of Peronospora infestans, because De Bary said the resting-spores were not likely to be found in the Potato plant, it was almost universally accepted as a fact that they never could be there found. Because conidia had not been described, it was commonly believed that no conidia existed. The mycelium of Peronospora has till lately been described as always destitute of suckers, but in some of the

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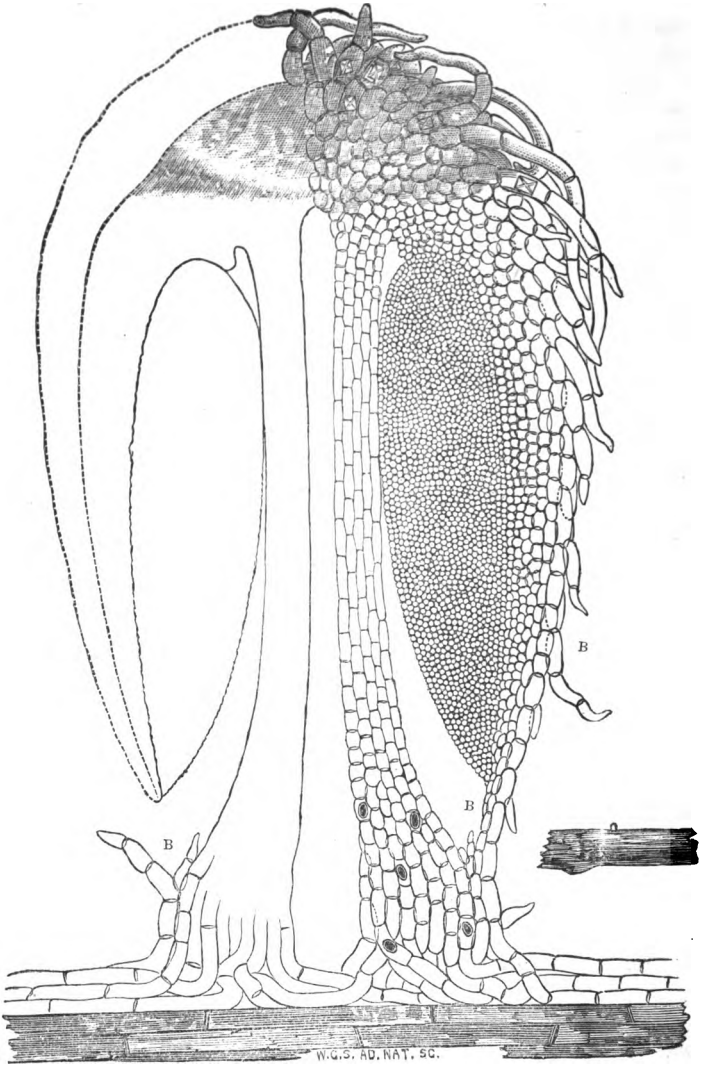
Plate VIII.



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REPRODUCTION OF COPRINUS RADIATUS, Fr.

PLATE VIII.

Young plant grown from spores immediately before expansion, enlarged 120 diameters.

B. Fine matted hairs forming the veil.

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Chiswick plants the suckers were abundant. The same fungus is commonly described as having its threads without articulations or septa, but it is equally common to see the figures of this fungus with septa in profusion.

Many botanists, as Corda, Bulliard, Klotzsch, and others, have considered the cystidium in Agaricus to correspond in some way with an antheridium, but as these views have not at present been favoured by Tulasne and De Bary, many botanists seem disposed to agree with De Bary in regarding the cystids as mere "pilose productions of a particular order," which is very indefinite, and the granules as mere conidia (Tulasne). Klotzsch and others have considered it possible that the spores are fecundated by a lubricating fluid given out by the cystidia. This fluid is evidently the same with the threads observed by me, and which at length gives birth to spermatozoids. I consider it quite possible that the mere contact of the threads (or fluid) from the cystidia with the threads from the unpierced spores may be sufficient for the production of a new plant. But De Bary, in criticising Klotzsch, says an opinion of this nature is entirely gratuitous, and the contact and its result, if real, would represent nutrition rather than fecundation, and, as far as he knows, there exists, he says, no other observation on any female organ susceptible of fecundation by the cystidia. I cannot fall in with De Bary's views at all, especially after the analogy found in Fucus and in the confervoid pollen (which has no outer coat), and which exhibits rotation in the flowering plants found under Zostera, Phucagrostes, &c., and which are fecundated when in a state of immersion in water.

As regards the spores of woody species of fungi, they are probably fertilised on the parent plant, and are blown away by the wind in a condition suitable to at once form the first cells of a new plant on any proper habitat. If Agarics were perennial and persistent, instead of being annual and fugitive, we might expect to see a new hymenium produced each year upon the lower surface of the old one, and this state of things really does exist in many species belonging to the perennial and persistent woody fungi of trees, where a new stratum of tubes is every year produced underneath the old one, so that the age of the fungus in years may be correctly ascertained by merely counting the strata. As to the mycelium itself, and the possibility of its producing sexual organs in Agaricus, I have had the subject before me for many years, and have seen many germinating spores, but no trace of any sexual organ other than the spermatozoids as produced from the cystidia themselves, or from the protoplasmic filaments which they throw out. I am therefore disposed to believe that the absence of sexual organs on the mycelium is owing to the threads being the produce of fertilisation.

As for the expressed juice of horse-dung, it abounds with nematoid worms, spores and infusoria of many kinds—no drop can be examined from a dung-heap after a shower of rain without seeing large quantities of these organisms. Therefore any uncertain thread taken for examination from dung is sure to lead to error. All my experiments were carried out in duplicate, one with expressed juice, and the other with distilled water, with very little difference in result, as the new plant seemed to live principally on the remains of the old parent.

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As a proof of how much there is still to be learnt respecting the life history of Agarics, I may say that in Sach's recently published *Text Book of Botany*, one of the very best and most complete books of its class ever published, there is no mention whatever made of cystidia in the description of Agaricus, and in La Maout and Decaisne's *Descriptive and Analytical Botany*, under fungi, it is stated that the male organs never produce antherozoids, and that the cystidia are always deprived of sterigmata or spicules.

To repeat and follow out these observations it is necessary to take the specimens for examination exactly at the proper period of growth, and to exercise the greatest care in securing an uniform moisture between the glasses. The life of the fungus is so short, and all the characters are so evanescent that the points to be observed may be present one moment and all gone the next.

All the drawings have been made with a camera-lucida, and from different specimens, so where the dimensions of the parts slightly disagree, it is only such a disagreement (within defined limits) as is commonly found in Nature.

THE POTATO FUNGUS.

Mr. Worthington G. Smith, F.L.S., also exhibited his drawings illustrating the resting-spores and life history of the Potato Fungus, the Peronospora infestans, and though he did not read a paper, made remarks to the following effect, though there is here incorporated some results not obtained till the ensuing spring, and published in the *Gardeners' Chronicle* :—

I last July obtained the oospores or resting-spores by keeping Potato leaves and tubers continually moist. For many years past moisture has been well known to be capable of greatly exciting the growth of Peronospora infestans, and De Bary in his recent essay classes the Potato fungus (p. 242), with "other water fungi." Mr. C. Edmund Broome of Batheaston, who is known as one of the first cryptogamic botanists of this country, repeated my experiments in the following manner: He selected potato leaves badly infected with Peronospora, partly crushed them, and placed them in a saucer of water under a bell-glass. The saucer was kept in a sloping position, so that the leaves (being partly submerged) were allowed to absorb the water naturally. The result was that he obtained an enormous number of resting-spores in all parts of the leaves, many being within the spiral vessels and hairs. These resting-spores were in every way identical with mine, and they could only belong to the Peronosporeæ or Saprolegnieæ, because similar bodies are unknown in other families of fungi. The first-named family has jointed threads, the second bears threads without joints; now as the threads seen by me, and last year illustrated in connection with the resting-spores, had jointed threads, they must belong to Peronospora, and not to Saprolegnia. As there is no other

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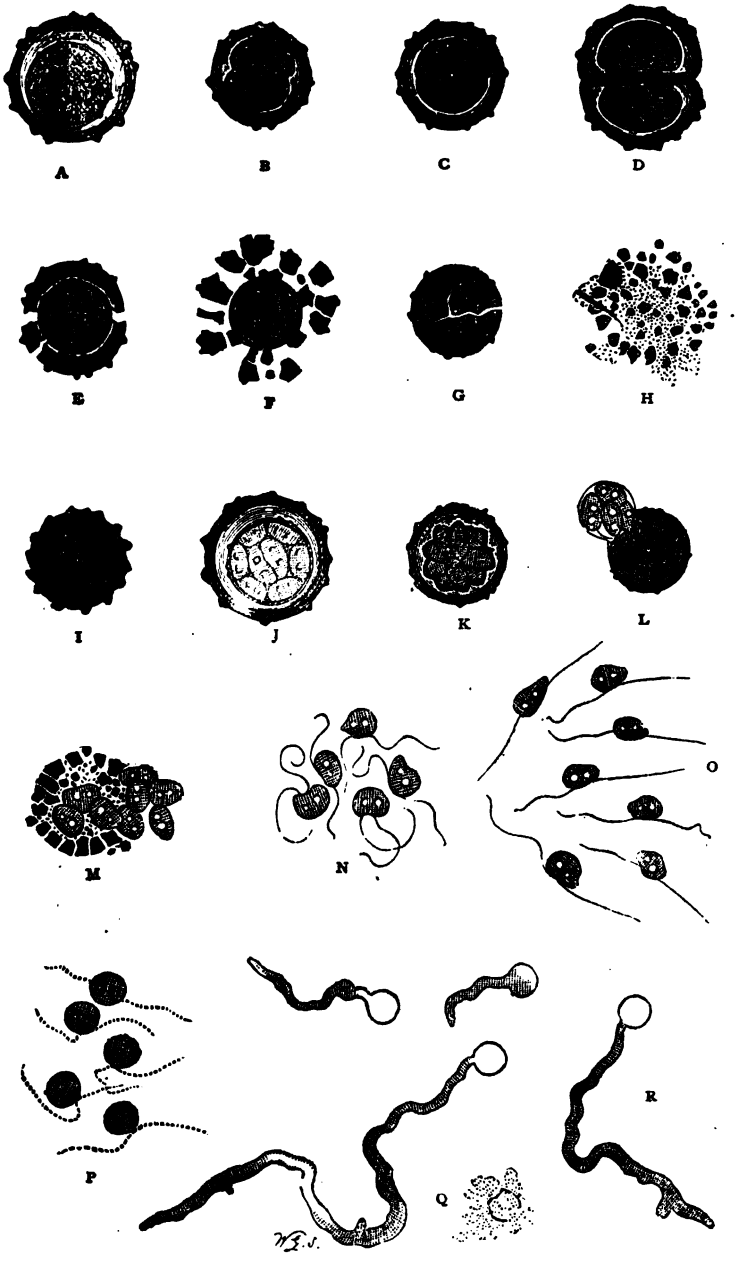
PLATE I.



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THE POTATO FUNGUS, PERONOSPORA INFESTANS.

PLATE I.

Resting spores of the Potato Fungus, enlarged 400 diameters, with zoospores and zoospores germinating.

A. Oospore within Oogonium.

B. Two resting spores within one Oogonium.

C. Three ,, ,, ,,

D. Double Oogonium.

E. Oogonium breaking up by cracking or
F. ,, ,, into atoms
G. Bladder thus discharged
H. Perishing in fine dust
} Oospores effete.

I. Germination commencing, Oospores filling all Oogonium.

J. Oospore breaking up into Zoospores.

K. Zoospores more mature.

L. Bladders containing Zoospores from within Oospore being discharged from Oogonium as in Cystopus.

M. Bladder breaking up into dust setting quiescent zoospores free.

N. Tails develope on Zoospores.

O. Anterior cilium is pushed forward.

P. Tails fall into fine dust, when at length Zoospores come to rest.

Q. Some Zoospores burst and perish.

R. Others throw out mycelium which bears the conidiophores of the new fungus.

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Peronospora than P. infestans known to grow upon the Potato plant, it is clear that the resting-spores cannot rationally be referred to any other than the Potato fungus. Added to this I last year saw the secondary bodies clearly growing from the Peronospora threads. I attach great importance to the jointed threads, because De Bary, when he figures Artotrogus from "Montagne's original specimen" (*Researches*, p. 258), shows the threads with many septa. From the first I have said that Montagne's Artotrogus and the bodies discovered by me are the same. That both belong to Peronospora the sequel will prove.

It was of the highest importance that these resting-spores should be preserved alive till the time arrived for their renewed activity, and with this purpose in view I preserved the material in which the resting-spores were present in sealed bottles, each bottle containing more or less pure water or expressed juice of horse-dung diluted with water. As I was quite in the dark as to the habit of these resting spores, of course I did not know what to do for the best, or what the result of my experiments would be. These resting-spores at first floated on the surface of the water, at length deposited themselves in the sediment at the bottom, and on opening one of the bottles the resting-spores are found still intact and apparently alive. Happily for me, nearly all my spores retained their vitality. Mr. Broome, being equally uncertain with myself, trusted to chance, and chance so far favoured him that all his resting-spores in the slanting saucer of water well retained their life. It might have been (and even was) said that possibly some fungus foreign to the Potato fungus had got into my material, but if so it must be regarded as a coincidence in the highest degree extraordinary that Mr. Broome should also get the same new and foreign fungus in his Peronospora material; a body so puzzling in its nature as to be referred to no less than eight different species of fungi.

All who have studied the habits of the lower fungi know the extreme difficulty of preserving the specimens alive. This difficulty almost amounts to an impossibility. The fungi under study may be present one day and all gone the next; a few drops of extra moisture or a slight current of dry air is sufficient to destroy or collapse the whole lot. Besides this myriads of other parasitic fungi, and whole tribes of infusoria commonly make their appearance and prey upon the material that is desired to be preserved.

Now one of the most extraordinary facts about the recent Potato investigations in this country is this. These other fungi and infusoria have not to any damaging extent appeared. Since I opened my sealed bottles in April I have kept the material under a bell-glass, and there has been no offensive odour, and to no appreciable extent have there been any moulds, infusoria or parasites except Peronospora infestans itself, and the other fungus which is equally destructive to Potatos and known under Fusisporium Solani. In investigating the Potato disease it was almost as important to discover the entire life-history of the Fusisporium as the Peronospora, and fortunately the materials preserved gave a perfect clue to the entire life-history of both. Mr. Broome's material has in the same manner been free from an excessive number of other fungi and infusoria.

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The germination of the resting-spores was awaited with the greatest anxiety, and as I never knew from one day to another whether or not these bodies might all collapse and perish, I was under the necessity of dividing the material, and keeping a constant look-out for results under different conditions. With this object in view, therefore, I kept some of the bodies moist in pure water, others in diluted expressed juice of horse-dung, others in expressed juice of fresh Potato leaves, others upon extremely thin slices of Potato and on crushed Potato mash, others in saccharine fluid, others in nitrogen gas, some between pieces of glass kept constantly moist, some upon broken tile (also kept constantly moist), and some upon Potato leaves as they grew upon the living plant. Besides this I have had a quarter of a hundred of slides, kept damp, and under examination every day (almost night and day) for the last three months. All these preparations I have kept constantly and uniformly moist under darkened bell-glasses, for darkness invariably assists the growth of spores of all sorts.

The first new fact worthy of note is this: many of the resting-spores grew in size during nine months of their rest to twice their original diameter, or about four times their original bulk, and their aspect gradually changed from almost smooth, semi-transparent bladders to brown, more or less rough and warted or echinulate spheres. These latter brown, mature bodies were quite the same in character with those so sparingly seen last June and July. How they arose last year no one saw, but probably the wet weather of the early summer caused their appearance. It does not follow, because the resting-spores have taken a year to artificially mature with me, that therefore they always take a year to ripen; it is quite possible that, in a state of Nature and under different conditions, they may mature rapidly. At any rate, two sorts of bodies were seen together last year, transparent smooth bodies, and rough brown ones. I considered them to be different states of the same resting-spores, and subsequent facts have proved my supposition to be quite correct.

The top row of illustrations on fig. 1 shows characteristic conditions of the almost mature reproductive bodies as drawn in April last. At A is seen the oospore (or resting-spore) within the oogonium (bladder which holds the resting-spore), at B may be seen two resting-spores within one oogonium, and at C three resting-spores within one oogonium, whilst at D is shown a double oogonium—two oogonia coalesced, and each oogonium containing a resting-spore.

At the end of April and beginning of May last I began to see the first signs of germination, and at this time many of the oospores proved effete; the oogonium cracked at E, or became broken into atoms, as at F, discharging a bladder, as at G, which perished in fine dust, as at H.

As the month of May progressed many of the resting-spores became dense and dark, with the oospore occupying the whole of the oogonium, as at I; this condition is different from that of the body A, for in this the resting-spore, being not quite mature, does not yet occupy all the oogonium, but floats within from side to side, as the object happens to be moved under the microscope. J shows the contents of oospore being broken up into zoospores; K shows the zoospores

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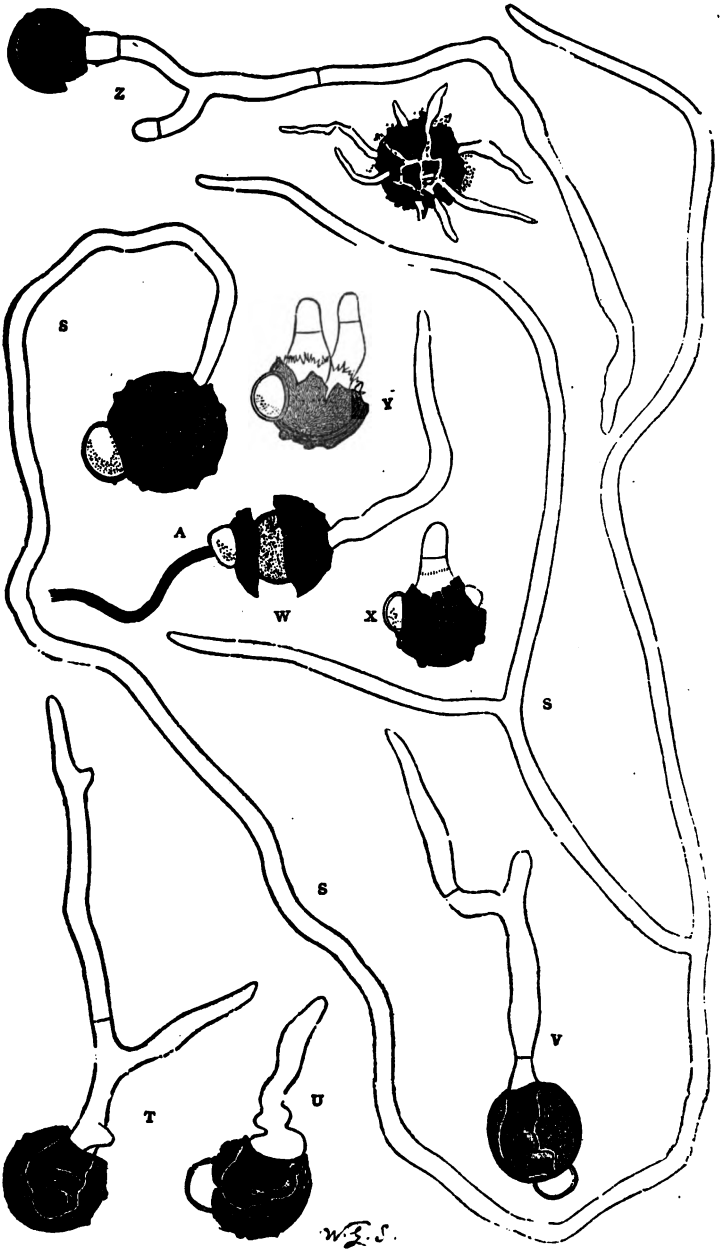
PLATE II.



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THE POTATO FUNGUS, PERONOSPORA INFESTANS.

PLATE II.

Germinating resting spores, enlarged 400 diameters.

S.S. Oospore throwing out threads of mycelium similar to average Peronospora infestans threads.

T.U.V. Similar characteristic examples. V shows two septa.

W. Oospore germinating with antheridium (A) attached to Oogonium, and still upon its last year's thread.

X. Germinating oospore showing first septum.

Y. Two germinating oospore with thread from one oogonium, each thread showing first septum.

Z. Shows three septa (specimen submitted to Rev. M. J. Berkeley.)

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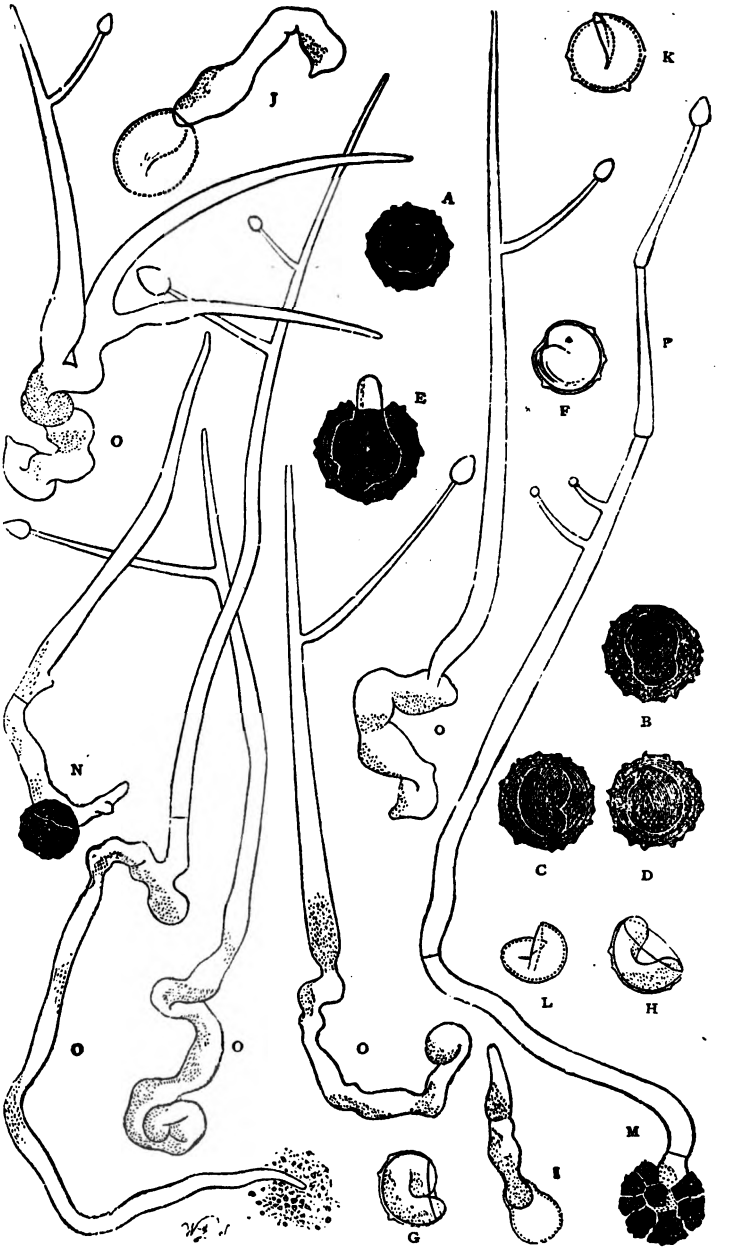
PLATE III.



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THE POTATO FUNGUS, PERONOSPORA INFESTANS.

PLATE III.

Resting spores germinating and reproducing the Peronospora, enlarged 400 diameters.

A.B.C.D. Oospores with germinating protoplasm coiled up within.

E. Coil emerges.

F.G. Coil sometimes expelled in its bladder before emerging.

H.I.J. Thread emerges.

K.L. Bladder sometimes left free, but broken.

M.N. Thread still in connection with oogonium (rare).

O.O.O. First mycelium, from which the Peronospora springs usually in a terminal manner.

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within still more clearly, and where they are giving an echinulate appearance to the bladder within (an appearance adverted to lately by Mr. Berkeley in a letter to the *Gardeners' Chronicle*) ; L shows the bladder from within the oospore being discharged from the oogonium after the manner of Cystopus, with the contained zoospores ; this bladder frequently breaks up into dust, as at M, setting the zoospores which are at present quiescent free, as at N ; two tails shortly appear on these latter bodies, and at a certain period of their growth the anterior cilium, or tail, is pushed straight out as seen at O, the posterior tail then quivers with an undulatory movement, and the zoospores sail out of the field of the microscope. How long the zoospores live it is difficult to say, but probably somewhere between twelve hours and a week ; at length they come to rest, as at P, when the tails fall into fine dust. Some zoospores burst and at once perish, as at Q, whilst others throw out threads of mycelium, R, which threads are destined at length to bear the conidiophores of the Potato fungus in its new generation. The zoospores thus obtained were planted on the foliage, and upon thin slices of Potato supplied from a frame by Mr. Alfred Smee. On these materials they at once produced mycelium and small conidiophores, which, without doubt, belonged to Peronospora, but as better results were afterwards obtained from resting-spores similar to 1, fig. 1, the figures are not here engraved.

The Rev. J. E. Vize, Forden Vicarage, Welshpool, a gentleman who has made a special study of microscopic fungi, has had some of my living material under examination during the past winter and spring, and when the first signs of germination showed themselves in my oospores, I wrote him to keep a good look-out for results. He wrote me as follows, under date of April 21 : "My idea certainly is that the oospores are germinating : bottle No. 1 had a thin film on it which developed into a lot of mycelium and threads of Peronospora ;" I, too, observe the same fact in London.

Throughout May the habit of the oospores appeared to remarkably change, for instead of producing zoospores they protruded a thick and generally jointed thread, this thread agreeing exactly in size with average Peronospora infestans threads. On May 13 I observed on the preparations treated with expressed juice of horse-dung threads similar to the very long branched thread shown at S, S, S, fig. 2 ; these threads were so long that they traversed the entire slide, and I could only detect a single septum or joint, and frequently none. T, U, V, are characteristic : the latter shows two septa, which is a common condition at this stage of growth ; and all three figures show the protoplasm of the oospore coiled up within the walls of the latter. W shows an oospore germinating with the antheridium (A) attached to the oogonium, and still upon its last year's thread ; X is a germinating oospore with a thread showing the first septum ; and Y shows two germinating oospores emerging from one oogonium, each thread showing the first septum ; the old male organ (antheridium) is still attached to W, X, and Y. The figure at Z, drawn on May 12, is characteristic, and shows three septa ; the specimen was sent on to the Rev. M. J. Berkeley, who replied : "I found the germinating oospore exactly as you figure it. There can be no doubt about the matter." Mr. Broome,

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who was examining similar material of his own, wrote on May 4: "It only remains now apparently to see the Peronospora arising from the threads which procced from the oogonia to prove the identity;" and again on May 20: "I do not see any attached conidia, but the space between the sections of Potato is covered with long threads resembling the conidiophorus threads, but I could not see any with the spores on them." It may be said here that no other known fungus has conidiophorous threads similar to those of the Potato fungus.

At the beginning of May, whilst observing the habit of Fusisporium and its resting state, I observed typical Peronospora infestans growing upon the drier parts of the previous year's crushed and decayed leaves; this observation was confirmed by Mr. Vize, who wrote on May 22: "According to my examination the Peronospora grows on the drier parts of the magma. I do not observe it growing on the very wet."

On figure 3 may be seen a collection of resting-spores before and in the act of germination, together with a number of Peronospora threads taken from Potato leaves and tubers previously infected with the oospores. A, B, C, and D show oospores in which the protoplasm which is destined to produce the new plant is coiled up within. At E this coil is seen just emerging. This convolute mass is really contained within a thin bladder, and sometimes the bladder is expelled, as in Cystopus, from the oogonium before the coil unwinds, as at F, G. The thread then emerges as shown at H, I, and J, sometimes leaving the bladder free but broken, as at K, L. It is rare to see the thread of the new plant in connection with the oogonium, as at M, N, though I have so seen it, together with the septa many times. The first mycelium or spawn of the new plant is seen at O, O, O, and from this the Peronospora springs direct, and (when artificially grown) almost invariably in a terminal manner. The conidia are not mature in any of the specimens here figured; doubtless this is because all the plants are more or less abnormal from being grown artifically, but still the threads are characteristic of Peronospora infestans, and no known fungus but the one which causes the Potato disease has vesicular swellings such as are shown at P.

Mr. Chas. B. Plowright (surgeon, of King's Lynn), a gentleman who has long studied fungi, has patiently examined some of the living material with which I have been working this spring and early summer, and he writes on May 19 to say: "I find plenty of branching, nodose conidiophores, especially amongst the drier portions of the substance sent. I also see living conidia. I have seen many conidiophores with convoluted bases, but in the vast majority of cases long ere the conidia come the oospore is gone; I see the granular protoplasm distinctly ascending the base of the conidiophore." As regards the first coil of mycelium, Mr. Plowright writes: "I distinctly saw this curved in two oospores, and I believe the mycelium comes out with a curl." The same gentleman, under date May 19, writes: "I saw a great many conidiophores both with conidia *in situ* and not; most conidia had fallen off; latterly I saw plenty of convoluted bases." The evidence of identity appears complete, and many of the figures here published, and others not published, have been confirmed by Messrs. Vize and Plowright.

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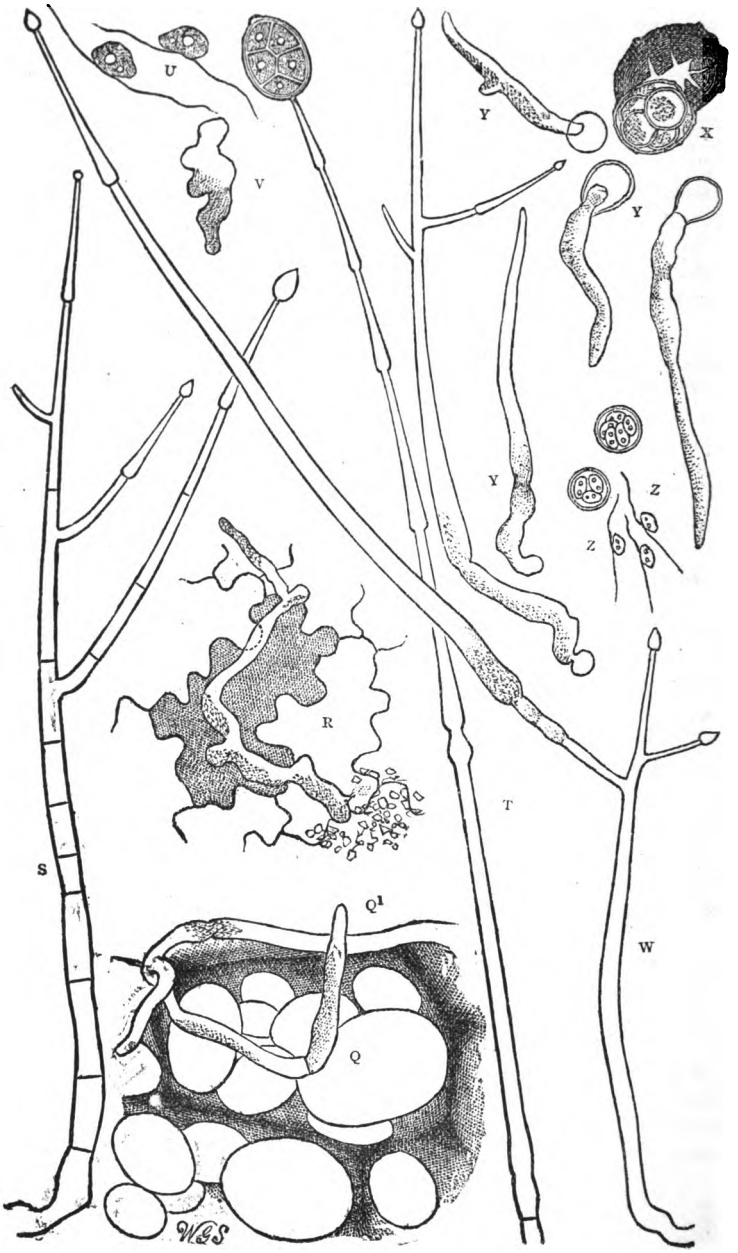
PLATE IV.



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THE POTATO FUNGUS, PERONOSPORA INFESTANS.

PLATE IV.

The fungus as reproduced from its resting spores, enlarged 400 diameters.

Q. Peronospora mycelium with young plant (Q^1) among starch of potato tubes.

R. Similar fragment of mycelium on cuticle of Potato leaf.

S. Branch of fungus with numerous partitions.

T. Well-grown branch with full-grown conidium at apex.

U. Conidium discharging zoospores.

V. Conidium discharging protoplasm.

W. Weak plant developing strong secondary thread.

X. Oospore with discharged bladder containing secondary bladders,

Y.Y.Y. which produce mycelium or Pythium-like,

Z. Zoospores.

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At Q on fig. 4 may be seen Peronospora mycelium with a young plant (Q_1) growing from amongst the starch of the Potato tuber, the dark background showing the cell wall corroded by the fungus, and at R a similar fragment of mycelium upon the cuticle of a Potato leaf; it is very common to see one cell of the cuticle thus discoloured by the corrosive mycelium, the corrosion of the cell being caused by the mycelium passing over and upon it. Both threads here shown come direct from last year's resting-spores. At S is engraved a branch of the Potato fungus, showing the numerous partitions with which the threads are at times furnished, and at T is a typical well-grown branch of the fungus, with a full-grown conidium at the apex; this conidium may either discharge zoospores, as at U, or an irregular mass of protoplasm, as at V, from either of which a new plant may spring, and in this habit the conidium agrees well with the resting-spore: the branch in this figure is shown as continuous, and though furnished with the vesicular swellings no partitions are present, the branches are frequently so seen. At W is illustrated a small weak plant, giving rise to a branch, which branch is developing into a large and strong plant; such a phenomenon is by no means uncommon, and shows how the fungus increases itself in every possible way. I have frequently seen this secondary thread branched.

During the last hours of completing this, the last engraving (fig. 4) illustrative of the Potato fungus, a new and curious fact came to light. On examining the oospores in saccharine fluid I observed some of the discharged bladders to be carrying from two to four secondary bladders inside (X); these secondary bodies were in their turn expelled, and grew and produced mycelium as at Y, Y, Y, whilst a few of the same secondary bladders burst and produced from three to six very small zoospores, generally only three. It is a most singular fact that these secondary bladders and zoospores are exactly the same in size with De Bary's Pythium vexans, and about one-sixth or eighth of the bulk of the resting-spores from which they were discharged. With this exception there has not been the slightest approach in any of my material to organisms which might be referred to Pythium. Mr. Plowright writes: "None of my oospores ever burst and produced Pythium or Pythium-like spores."

My material has contained a large number of dead mites and aphides and a few nematoid worms; the oogonia and threads were to be seen in all parts of the dead insects, but not in the worms.

De Bary, in reviewing my observation, says:—"Even if the often mentioned warty bodies were hibernating oospores of Phytophthora (Peronospora), like the similar oospores of P. Arenariæ which resemble them, we shall not gain much information bearing upon these questions, since their ocurrence is, at the best, extraordinarily rare." This sentence is very erroneous, for although the bodies were apparently rare when I first recorded their discovery, they were not necessarily so in a state of Nature, for on continuing the experiments after my first essay was written, the resting-spores were produced in myriads, and that, too, within the tissues of a comparatively few leaves. During the present spring I have sent mounted preparations of the mature (or almost mature) resting-spores to

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many of the foremost cryptogamic botanists of Europe, but no one has denied their possible identity with Peronospora infestans.

For more than thirty years our Potato crops have been systematically destroyed by two virulent fungi, viz., Peronospora infestans and Fusisporium Solani; these two parasites almost invariably work in company with each other, they suddenly appear for a few weeks, destroy our crops, and vanish for ten or twelve months, then reappear and repeat the work of destruction. I claim for my work that it is new, and that it has proved how both these fungi hide and sleep through eleven months of the year. As I have kept the resting-spores of both parasites alive artificially in decayed Potato leaves in water, in moist air, and in expressed diluted juice of horse-dung it conclusively proves to me that the resting-spores hibernate naturally in the same manner. The seat of danger from both parasites is clearly in dung heaps, ditch sides, and decaying Potato plants.

Any method of destroying the resting-spores of these pests, or of warding off or mitigating their attacks, obviously depends in a great measure upon a full knowledge of their life-history. That life-history I have endeavoured to the best of my ability to watch and describe for the *Gardeners' Chronicle*, and I am content to let the observations stand on their own merits. Sensibly conducted and extensive field experiments might probably teach some valuable lessons, but it is difficult, if not impossible, for any single individual, whether farmer or botanist, to institute and carry out such experiments.

With these notes I am only too glad to bring the whole subject (as far as regards my work upon it) to an end. Any one who feels so disposed, and has the time and patience to go over all the experiments and observations again through another entire year can do so.—*Worthington G. Smith.*

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Woolhope Naturalists' Field Club.

The general annual meeting of the members of this Club was held in the Club-room at the Free Library, Hereford, on Thursday, March 9th, 1876, present:—the Rev. Charles J. Robinson, president, in the chair; the Rev. Wm. Jones Thomas and William A. Swinburne, Esq., vice-presidents for 1876; C. G. Martin, Esq., and J. Griffiths Morris, Esq., members of the central committee; the Rev. Sir G. H. Cornewall, Bart., and the Rev. H. Cooper Key, members of the editorial committee; Thomas Cam, Esq., treasurer for 1876; Mr. Arthur Thompson, secretary; Thomas Blashill, Esq.; Frederick Bodenham, Esq.; Dr. Bull; Dr. Chapman; James Davies, Esq.; T. Lane, Esq.; Rev. G. M. Metcalfe; J. E. Norris, Esq.; J. Riley, Esq.; Orlando Shellard, Esq.; Rev. C. J. Westropp; and Rev. R. H. Williams.

The retiring treasurer presented his statement of the accounts for the year 1875, showing a balance in favour of the Club of £133 6s. 7d., together with arrears amounting to £47 1s. 6d., of which arrears the sum of £13 has been paid to this date.

Proposed by W. A. Swinburne, Esq., and seconded by J. E. Norris, Esq., and carried:—"That in future a balance sheet of the year's accounts, duly audited, shall be printed and circulated with the notice of the annual meeting."

Resolved:—"That Messrs. Fowler and James Davies be appointed auditors for the present year."

Dr. Chapman, Burghill, was proposed by Thos. Cam, Esq., and seconded by William A. Swinburne, Esq., and unanimously elected president for the present year."

The following times and places were fixed for the field meetings for 1876:—First, Tuesday, May 23rd, Woolhope; second, Tuesday, June 27th (ladies' day), Llanthony Abbey; third, Tuesday, July 25th, Old Radnor for Stanner to meet the Caradock Field Club; fourth, Friday, August 18th, Brown Clee; fifth and last, Thursday, September 28th, for the usual "Foray amongst the Funguses"—the place not fixed.

Resolved:—"That the editorial committee be entrusted with a selection of books for the Club Library, and that the members be requested to forward lists to the committee to select from."

John Riley, Esq., of Putley Court, exhibited some Roman remains discovered in the restoration of Putley Church, and Mr. Blashill, the architect, made some remarks on them, and exhibited some Roman remains from Kenchester.

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Euplectella Aspergillum, Venus flower basket and Pennatula Spinosa (Seapen), were exhibited by Mr. T. Lane.

The following gentlemen were proposed for election as annual members at the first field meeting :—Captain Doughty, Hampton Park, Hereford, proposed by Mr. Arthur Thompson, and seconded by J. T. Owen Fowler, Esq., Rev. John Goss, the College, Hereford, proposed by Mr. T. Lane and seconded by Dr. Chapman.

The thanks of the Club were voted to Mr. T. Lane for a copy of the 4th edition of Dr. Carpenter on the microscope for the Club Library.

The Secretary laid on the table the meteorological reports for the past two years, by E. J. Isbell, Esq., with the register of flood water on the Wye for the same period, by Messrs. Stephen and Thompson.

The members afterwards adjourned to the Green Dragon Hotel to dinner, when they were joined by the following :—J. F. Symonds, Esq., and Mr. With (members), and C. M. Field, Esq., and C. Aston Key, Esq. (visitors).

Immediately after dinner the president (the Rev. Charles J. Robinson) delivered his retiring address.

Afterwards a paper on the radiometer was read by the Rev. H. Cooper Key, which subject was illustrated by experiments and explanations by himself and Mr. With.

RETIRING ADDRESS OF THE PRESIDENT.

It is reckoned as one of the dramatic proprieties that no actor should leave the stage withought some words upon his lips wherewith to cover his retreat ; and in accordance with this rule your president is not permitted to make a silent exit from the scene in which for twelve months he has been playing his allotted part. I should scarcely be an Englishman if I omitted to preface my address with some observations on the weather. Varied as our Field meetings were as regards locality, in one respect they were marked by a disagreeable monotony. On no single occasion was there absent that discordant element—a fall of rain—to damp the ardour of the naturalist, to try the temper of the antiquary, and generally to mar the pleasure of those lovers of nature who form the bulk of our excursion parties. Judging by our own experience as Woolhopians we should be disposed to say that the summer of 1875 was the wettest on record and no doubt the rainfall was in some places exceptionally great. In the volume and frequency of its floods throughout Central England and South Wales this year was especially memorable, and few of us are likely to forget the aspect of the Severn and Wye valleys on the 16th July after two days of continuous downpour. Mr. Isbell's carefully compiled tables will enable us to estimate accurately the share in this too copious rainfall which our county received, and as I observe that in Monmouthshire at

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several stations more than five inches were recorded, it is not unlikely that that depth may be paralleled nearer home. It will be useful to compare the wet summer of 1875 with that of 1872, for although there is a tendency in the human mind to exaggerate the dimensions of a present calamity and to forget the relative proportions of past events, yet these two years are sufficiently near together in our memories to admit of being easily judged. In both, the wet summer was ushered in by a remarkably fine and dry May; in fact the first half of that month and the latter half of April embraced the best weather we experienced in either year, but the autumn of 1872 was in every respect superior to that of 1875. As to the winter, there arises the question whether its character confirmed the truth of Gilbert White's statement, "that intense frosts seldom take place till the earth is perfectly glutted and chilled with water. Now I do not think that the winter of 1872, or that which I hope is now over, were seasons of extreme rigour: we have had cold winds and numerous heavy falls of snow, but the average temperature has not been abnormally low nor have there been frosts of unusual length and severity. It would perhaps be safer to say that after a wet summer there is a probability that the early months of the winter will be colder than the later months. It must always be borne in mind that wide generalizations frequently conceal more than they reveal, and on the other hand that personal experiences when taken alone are worth very little. Then, if in the past year we were to take our average of the rainfall from the returns of the whole British Isles, it would be found to give merely an excess of 7 per cent., for upon the east coast of England, in Lancashire and the lake districts, and in many parts of Scotland, there was a considerable deficiency of rain. But over a limited area, within which we were unfortunately situated, the fall was the largest and the most disastrous experienced within the last 20 years. I have ventured to dwell a little upon the subject of weather because it is one in which Englishmen are thought to be profoundly interested. It certainly occupies a prominent place not only in their conversation but also in the journals which they read. May we not hope that upon the data which are being so rapidly accumulated a scientific system of meteorology will ere long be based, and that at any rate the Woolhope Club will be able in future to select fine days for its excursions.

Our first and most successful field meeting (albeit held within a town and amid showers of rain), took place on the 20th May, at Caerleon-upon-Usk, once the station of the 2nd Augustan legion, and in a later but more obscure times the scene of Arthurian romance. The Club was fortunate in having amongst its members one gentleman—Mr. J. E. Lee—who, having devoted many years of his life to the study of the antiquities of the place, kindly placed his services at our disposal. Under his guidance the interesting contents of the local museum, chiefly collected by the zeal and munificence of our cicerone, were carefully inspected. We saw a large number of sepulchral and other inscribed stones, a tessellated pavement brought from Caerwent, Tuscan pillars, which once supported a temple of Diana, a series of coins dated from the time of Otho to that of Augustulus, stone coffins, *amphoræ antefixæ*, armlets, enamels, and Samian ware of foreign and domestic manufacture. The attention of the Club was especially

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directed to a broken slab in which was represented, very spiritedly, a combat between an English mastiff and some wild animal; and also to two inscriptions in which the name of Geta (the younger son of Severus) had been mutilated and partly effaced, bearing evidence to the hatred in which he was held by his brother Caracalla, and confirming in a remarkable way the truth of written history, and the still wider truth that "the evil which men do lives after them." The contents of the museum enabled the Club to realize very vividly the former importance of Caerleon, as well as to view with interest the traces of a Roman villa which Dr. Woollett had discovered in his garden. His grounds include also a lofty mound, clearly of artificial origin, which may have supported

> The giant tower
> From whose high crest they say,
> Men saw the goodly hills of Somerset.

Or, perhaps, the more substantial keep which in historic times was attached to the extensive castle mentioned in Domesday. The point is one which we cannot now determine. Suffice it to say the view from its summit amply rewarded those who made the ascent and the exertion of climbing rendered them better able to do justice to the good fare which awaited them at the Priory. After a dinner which must have taxed the skill and the resources of the monastic cook to provide, our genial host—Mr Lee.—read to the Club a very interesting paper, which, with its accompanying illustrations, will form a prominent feature in the next volume of our transactions. Throughout the day—which in the memory of your President is marked with a white stone—there were frequent allusions to King Arthur, and the connection of this place with our great hero of Romance. It was thither, so some say, that "the blameless king" came at Pentecost to be crowned and held high festival with chieftains from Lothian and Orkney, from Gower and Carados. There, too, if we accept the Laureate's version, the Prince Geraint brought his fair bride Enid, and

> By the hands of Dubric, the high saint,
> They twain were wedded with all ceremony.

The incredulity of modern times has boldly pronounced Arthur to be a myth and his whole history a fable, and it must be confessed that as yet neither Mr. Lee nor any one else has done for Caerleon what Dr. Schliemann has been doing for Troy—exhumed the splendid palaces which, as Geoffrey of Monmouth says "once emulated with their gilded roofs the grandeur of Rome." Yet I cannot but believe that beneath the Arthurian romance as well as below the Homeric epic there is a substratum of truth, although in both instances by a natural process of development a simple story has become complex, and incidents and characters widely separated in time and place have been rashly joined together. We see this especially in the legend of King Arthur—a Kymric hero, but not one of the Kymry of Wales, unless we adopt the latest hypothesis and believe that all the Kymry were immigrants from Armorica. Anyhow, we cannot doubt that the nucleus of the romance was derived from Brittany. From that country it passed across the channel to Cornwall, where most of its scenes are laid by the earliest chronicles, and so through Devonshire it came to Somerset—its next important

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stronghold. Now, supposing it to commemorate the struggle made by the indigenous race under able leadership to resist the invasions of Saxons or of Picts and to stem the tide of barbarism which set in after the Romans had departed, it is easy to understand how in its onward passage local legends which had reference only to some local hero—some village Hampden—would become absorbed in the larger romance. Thus Arthur (and I am told that Arthrws in Welsh means only a strong, heroic man), would become, not merely like Mrs. Malaprop's Cerberus "three gentlemen at once," but the embodiment of a hundred valiant chieftains, of whose doughty deeds the bards of a hundred districts had sung. Now there is every reason to believe that Geoffrey of Monmouth, who was born about the year 1100, was familiar with the Breton romance in which the Roman wars of Arthur are described and numbers of foreign places named which would be unknown to the Kymry of Wales, and we may also take it for granted that he was familiar with the legends preserved by Gildas and the so-called Nennius. What can be more likely, then, that when he viewed the relics of past grandeur at Caerleon and heard the traditions there current of its glorious past, he should connect these with the reign of Arthur, and for the first time make that place the scene of his hero's exploits? I say "for the first time" because so it seems to be. The Hengwyst Romance of St. Greal fixes the palace of Arthur at Camelot, in Cornwall: later Mabinogion, at Gelliwig, in the same county, and it is only in the post Norman stories—whose date is betrayed by their reference to the system of knight errantry—that the name of Caerleon is introduced. While therefore we maintain that Arthur was a veritable hero—or more than one—who lived and loved, fought and died in that dim period which succeeded the departure of the Romans, we must cease to claim him as one of the Cymry of Wales, we must give up as hopeless the attempt to fix the date of his existence or to determine his identity, and rest contented with being unable to reconcile his exploits with probability or his wanderings with geography. But we have lingered too long in "old Caerleon," and your President has been tempted to forget that his own antiquarian studies may be distasteful to those members of our club who tread the steeper paths of science.

Our second meeting was held on the 15th of June, at Symonds' Yat, under circumstances even less favourable for out-door enjoyment than we had experienced at Caerleon. The fair prospect on which we had hoped to gaze was partly hidden by gathering clouds, the contents of which were discharged upon our heads as we passed through the outskirts of the Forest of Dean on our road to Monmouth. But in spite of all obstacles and discouragements the programme was duly carried out and a fair number of Woolhopians, more or less drenched, mustered at the Buckstone. Amongst these your President was not included. Whether prudence dictated to him a more rapid march upon Monmouth, or whether he feared to submit himself to the ordeal of other Druidical rites which the rocking stone would suggest, is immaterial. But perhaps those who, like himself, were absent from the spot, may be interested in learning what the Buckstone—the main object of the day's excursion—really is. It is a mass of conglomerate silicious grit, irregular

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in form, but somewhat resembling an inverted pyramid, 54 feet in circumference at the top and 3 feet at the base. Its shape is no doubt due to natural causes, and its position, poised on the edge of a limestone escarpment, favours the notion that it may have been used in past times as a rocking stone. But on this occasion—either because the efforts of our Club (thinned by the tempestuous weather and weakened by want of food) were too feeble, or because the consciences of some of our members were not wholly innocent—the rock refused to rock. Had your President been there it is possible that his predilections for Druidism might have forced him, in spite of all evidence, to maintain, with Galileo, "e pur si muove." After a brief glance at Monmouth we returned to Ross by railway, passing far too rapidly through the lovely scenery of the Wye Valley, where the noise and smoke of the locomotive seem out of place. The disappointments of the day were forgotten in the pleasant meeting which we had with the Cotswold Club at the dinner-table, and truth compels me to add that the only important contribution made to science on the occasion came from a Cotswoldian and not a Woolhopian. Dr. Wright, of Cheltenham, whose reputation as a geologist is European, drew the attention of the two Clubs to the recent discovery made of ophiuræ in the Garden Cliff section near Westbury in the dark shales of the avicola contorta series. The smaller ophiura, *Ophiolepis Damesii*, Wr., was first found near Hildesheim in the avicola contorta shales and sent to the museum at Berlin after having been identified by Dr. Wright. Since then the same species has been found in several localities in England, and recently in beds of the same age in Ireland. In connection with the same subject Dr. Wright gave some interesting particulars of the bone beds at the base of the Devonian, Carboniferous, Jurassic, and Cretaceous formations.

In our third Field Meeting, July 13th, we were favoured with the presence of ladies, and as a consequence or a compliment the sun occasionally shone upon us. It could scarcely shine upon fairer scenes than those amidst which our day was passed, and I, for one, feel indebted to the Club for giving me an opportunity for visiting a district so full of interest and, ordinarily, so inaccessible. We met at Pontrilas Station and started immediately for Kentchurch, where some little time was spent inspecting the church and its numerous monuments to members of the Scudamore family. The mansion of that ancient Herefordshire race was closed on account of the recent death of its last male representative, but it may be some consolation for the Club to know that it possesses very few features to suggest the fact that for five centuries it has been the home of the Scudamores, and that within its walls Owen Glyndwr often found a refuge. A rough but picturesque mountain road brought us from thence to Garway, where a visit was paid to the church with its Saracenic chancel arch, detached tower, and quaint memorials of the Templars and Hospitalers, who lived hard by. The solitary fragment of their preceptory—of which even in the 17th century there were "stately ruins"—consists of the Columbarium, which we learn from a fast vanishing inscription was erected in 1323. It afforded accommodation for 600 doves, but in its present state would be a very foul nest for any bird. The "genius loci" has either deserted Garway or has failed to secure a votary in its proprietor. I could say much about the beauties

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and the historic associations of that border land wherein our Ladies' Day was spent. But to what purpose? Those who were present are not likely to have so soon forgotten its charms, and to those who were absent no words of mine could reproduce the scene or compensate them for what they lost. Some slight sketch of the past history of Skenfrith and Grosmont—the two old castles within whose ruined walls we stood—I attempted to give when on the spot, and this—in perhaps a revised form—will duly appear in the Transactions of the year, and I trust may stimulate others to "ramble beyond railways," and search for themselves among the nooks and corners of neglected history.

On the 10th of August our Club, like the witches in Macbeth, "met again in thunder, lightning, and in rain" at Brecon. This is our usual fate there; and, rendered prudent by past experiences, we confined ourselves on this occasion wholly to the town. There is certainly enough there to afford very pleasant occupation for a day, and I am sure that many others besides your President were glad to renew and extend their acquaintance with a place so full of interest. The grand old Priory Church, which, at our last visit, was in the hands of workmen and choked with scaffolding and ladders, could now be seen to the best advantage, and in the survey made of it we had the benefit of Mr. Garnons Williams' able guidance. The beauty and grace of the Early English presbytery are almost without parallel in South Wales, and contrasts in a very marked way with the vast octagonal piers and broad arches of the nave. The Norman font with its quaint carvings, the curious sculptured slab with figures in bold relief adorning the Holy Rood, the numerous monumental slabs which meet one's eye at every turn combine to render the Priory Church a fabric of unusual interest, and well fitted to become—as I hope some day it may be—the seat of a new Bishopric. I can but allude to the College Church—a chancel of which has been lately restored—it forms an elegant example of the First Pointed style, within the walls of which many of the Bishops of St. David lie, and chief among them Dr. George Bull, the most learned of Bishop Thirlwall's predecessors.

But I must pass on to what has now become the great event of the Woolhopean year, viz., the Fungus Foray. And here I must humbly confess that the subject is one to which I can do but scanty justice. My ignorance prevents me from discussing its scientific side as well as from enjoying many of those delicacies which mycologists are thought to have added to our national cuisine. Yet if I am to speak on the subject, and to speak the truth, I would dare to hint—even before such an audience—that the economic value of funguses has been a little over-rated. I speak without prejudice, for I am always ready, in faith, hope, and charity, to partake of any mushrooms which come before me with a good character. But hitherto I have tasted nothing equal to the common mushroom *(Agaricus cam pestries)*, and it is scarcely fair to say that *that* species meets with any neglect in this country. Most of the other esculent fungi are either very local, very short lived, or occur in insufficient quantities to make them important as articles of food. Of course there is something very attractive in the belief that mycology will teach us how to gather in the woods and fields beefstakes, omelettes, oysters, and sweetbreads *à discretion*. The great meat difficulty seems to be solved at once; our

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society will take the place of the Farmers' Club. Shorthorns and Devons will give place to Chanterelles and Orcellæ, and all Herefordshire will be turned into a mushroom-bed. Be it so, if the progress of science so ordain; and meanwhile, in preparation for this good time, let us educate the cooks and revise the cookery books—commencing with our own Club receipts. Surely it is a culinary solecism to serve up beef with beef, and I must therefore take exception to the receipt that *Fistulina Hepatica* should be employed as an adjunct to its animal congener. If the former possesses all the characteristics of the latter and is to have any economical value, it should be substitute for—not merely an addition to—the sufficiently popular beef-steak. As a further contribution to this branch of the subject let me call the attention of the Club to a curious letter in the Sloane collection (MS. 4292) dated Hereford, 15 Nov., 1659. In it the writer, who was evidently a travelled physician—the Dr. Bull of the period—notices the passion of the Italians for mushrooms. "I have eaten the dish," he says, "often at Sir Henry Wotton's table (our resident ambassador at Venice), always dressed under the inspection of his Dutch-Venetian Johanne or Nic. Oudart, and truly it did deserve the old applause: as I found it at his table it was far beyond our English food. Neither did any of us find it of hard digestion, for we did not eat like Adamites but as modest men eat of much melons. If it were not hurtful to hold any kind of intelligence with Nic. Oudart I would ask him Sir Henry Wotton's art of dressing mushrooms, and I hope *that* is not high treason." May we hope, that in deference to the writer of this letter, who may be called the father of mycophagy in Herefordshire, the cook will at our next banquet prepare us a dish of what Massinger calls "the Italian delicate—*oiled* mushrooms? But to turn to the scientific side of the question. The Woolhope Club may be fairly congratulated upon the work done by its members in this direction. It has been the means of adding to the list of British fungi during the past year six species hitherto unknown in this country. If the Foray had produced no other fruit than this it would be sufficient to justify the gathering; but in truth the presence amongst us of such men as Dr. Cooke, Messrs. Rennie, Plowright, and Worthington Smith, gives life and vigour to our Club, as well as an impetus to the study of Cryptogamic Botany. Another matter for congratulation is the entire success of the Pomological Exhibition. It far surpassed my expectations, and bids fair to become an institution of great practical value. In Herefordshire any one with a rood of land may safely calculate upon raising roses and apples, but of late years a good deal more attention has been bestowed upon the former than upon the latter, and the Club will be doing good service if it helps to re-establish the reputation for fruit which our county anciently possessed. At present in nearly every garden much space is occupied by trees which bear only inferior fruit; worn-out grafts which have long outlived their fame still linger in the soil, and ignorance and prejudice combine to exclude new varieties which elsewhere have secured an honourable place. It is for the Woolhope Club to find a remedy for these evils, and, following in the footsteps of Scudamore and Phillips, Andrew Knight and Uvedale Price, make Herefordshire once more the Orchard of England, and teach the United States that we can grow something better than even their much vaunted Newtown pippins. I have not yet seen the Report of

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the Committee, and I may be but echoing its words when I add that our next exhibition must be upon a larger scale; that, with due restrictions, the public should be added to it, and that the judges should do their best to establish a regular and scientific classification of the fruits exhibited. At present the nomenclature is very confused, and the same fruit appears to bear half-a-dozen different names in as many different parishes, and—to make confusion worse confounded—old varieties are sometimes re-introduced under a new designation.

And now to turn from ourselves to the larger world outside us. In the past year we have not been startled by any fresh hypotheses as to the origin of this globe or of those that inhabit it. Professor Tyndall, it appears, has been devoting himself rather to the service of Venus than to that of Minerva, and Sir John Lubbock has turned his attention from primeval man to the lives and conversations of ants and bees. It is too soon to speculate upon the advantages which are likely to accrue from the Arctic Expedition: all that we can at present say is that its despatch proved—if proof were necessary—that English naturalists are not behind English seamen in pluck and enterprise, and that it augurs well for the interest in science felt by the present Government. The Deep Sea exploration has added much to our knowledge about the conditions of animal and vegetable life at the bottom of the ocean, and has upset many theories on the subject which had been previously current; the world-wide observations on the Transit of Venus cannot but have been of service to astronomy, though they seem to have involved no new discoveries, and from the Sub-Wealden exploration—undertaken for the purpose of disclosing what kind of palæozoic or primary rocks there lie beneath the secondary formations, the results obtained have been disappointing. The boring has now attained a depth of 1,900ft., and is still in the oolitic strata. It seems a pity that such an enterprise should be checked for want of adequate means to carry it out, and as an effort is now being made to raise an additional sum of £2,000 so as to extend the boring another 500ft., I venture to say that the Woolhope Club would do well to offer a donation from its corporate funds.

The obituary of the past year is unhappily a long one. From our own ranks we miss two members—the Rev. E. Du Buisson and Rev. Samuel Clark—of more than average worth. The former was a skilful botanist; the latter—known to the world at large as a deeply-read theologian—was known and valued by us as a zealous fellow-worker, and most agreeable companion, whose copious stores of knowledge were always open to every inquirer. But our losses, however much they may be felt by us as individuals, are but trifles as compared with those which science has sustained by the deaths of Charles Kingsley, whose skilful pen transformed the Book of Nature into a fairy tale; of Prof. Wheatstone, to whom we owe our present system of telegraphy; of Dr. John Gray, whose services to zoology every visitor to the British Museum can appreciate; of Prof. Willis and Sir Gardner Wilkinson, whose names are severally identified with Architectural History and Egyptology; and lastly, but chiefly, of Sir Charles Lyell, an hon. member of the Woolhope Club, and, without controversy, the ablest geologist whom the present generation has seen. The world moves onward, and the places

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of those who fall from the line of march are soon supplied, but their work is not forgotten. No true work is ever done in vain; if it has not aided others, it has at least had a beneficial effect upon the worker himself; if in itself it has been but a trifle, yet it will help to swell the aggregate knowledge and increase the inheritance of the next generation.

"CAERLEON."

The following note is from the "Hereford Times" of June 12th, 1875, under signature of John Davies, Brynafall, Abergavenny:

Caerleon cannot be a corruption of "Castrum Legionis," because the word "Caer" is purely British, and has nothing Roman about it, and was a component of British names a long time before the word "Castrum" or "Castra" was introduced into the country. The word "Caer" always means a British fortress, and the British fortresses in this country are older generally than the Roman fortresses.

I submit that the origin of Caerleon is "Caer-Llengoedd," the literal translation of which into Latin would be "Castrum Legionum." Whether there was a British town at Caerleon prior to the Romans I am not prepared to say. The fact that the town was called "Caerllengoedd" by the ancient Britons does not necessarily imply that there was a British military camp there. I agree with Mr. Lee that the British name came from the Roman, but *vid* translation, and not *vid* corruption. Caerleon is called to this day by the Welsh-speaking people Caer-lleon. Caer-lleon is a corruption of "Caer-Llengoedd," and Caerleon is the Anglicised form of Caer-lleon.

I ought to add that "llengoed" means legions, being the plural form of "lleng" (*legio*).

The word "Caer-Llengoedd" is highly descriptive, and implies that it was a place of importance and magnitude, its meaning being the camp of legions.

THE RADIOMETER.

The little instrument you see before you, the phenomena displayed by which still remain a mystery to scientific men, originated in some experiments which Mr. Crookes was making in the year 1873 on the transmission of heat from one body to another. He had been using a vacuum balance, for the purpose of weighing certain substances whose temperature was higher than that of the surrounding air and the weights, and while doing so he noticed a remarkable phenomenon, viz., an apparent diminution of the force of gravitation; and in order to investigate the nature and cause of this strange effect, he devised and constructed a number of forms of balance—each successive one being more delicate than the last,—which enabled

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him, in his own words to the Royal Society, "to detect, and then to render very sensible, an action exhibited by heat on gravitating bodies, which is not due to air currents, or to any other known form of force."

One of Mr. Crookes' first forms of apparatus consisted of a balance formed of a straw beam with a pith ball at each end of it, the whole being enclosed in a glass tube filled with air at the ordinary density. On passing the flame of a spirit lamp across the tube, under one of the pith balls, the ball descended slightly, and then immediately rose to considerably above its original position. The inference from this was that the true action of heat is one of attraction, instantly overcome by ascending currents of air. He then went on to ascertain whether the density of the enclosed air had any effect one way or the other upon the phenomenon. The apparatus being connected by fusion with the Sprengel air pump (the barometer being at 767 *millemètres* and the guage at zero), the pump was set to work; and when the guage was at 147 millms. below the barometer, the experiment was tried again, with a small globe of hot water at a definite temperature instead of the spirit lamp. The same result, only more feeble, was obtained. The exhaustion was continued until, when the guage was at 12 millms. below the barometer, the action of the hot body was scarcely noticeable. When there was a difference of only 7 millms. between the guage and the barometer, neither the hot water globe, nor the spirit flame caused the pith ball to move in any appreciable degree. Mr. Crookes naturally inferred from this that the rising of the pith ball was really due to currents of air, and that at this near approach to a vacuum the remaining air was too highly rarefied to be able to overcome the inertia of the straw beam and the pith ball; that there would still be some traces of a movement at a still nearer approach to a vacuum; but it seemed evident that when the last trace of air was removed from the tube round the balance, and the balance suspended in empty space only, the pith balls would remain absolutely motionless when the spirit flame was brought near them. However, he continued exhausting, and when he next applied heat he found he was far from having discovered the law of the phenomena,—the pith ball rose steadily instead of falling first, and much more readily than before. When the guage was at 3 millms. below the barometer, the ascension of the pith ball, when a hot body was placed beneath it, was equal to what it had been in air of the ordinary density; and, when the guage and the barometer were level, the upward movement was not only sharper than it had been in air, but it required much less heat to produce the same effect; even the warm finger applied to the globe instantly sending up the ball to its fullest extent. A piece of ice was found to produce exactly the opposite effect of a hot body.

Mr. Crookes' next step was to ascertain whether electricity in some form had any share in producing these phenomena, and after an exhaustive series of experiments he was able to demonstrate that it had none whatever. It would weary you if I were to mention half the experiments which Mr. Crookes tried in the course of the next few months; it will be sufficient to say that having experimented for some months with an apparatus similar to that which Cavendish used in his celebrated investigations on gravitation, he obtained the following results. A

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heavy mass of metal, when brought near a delicately suspended light ball, attracts or repels it as follows: when the ball is in air of the ordinary density, if the mass is colder than the ball, it repels the ball; if it is hotter than the ball, it attracts the ball. But when the ball is in a vacuum, if the mass is colder than the ball it attracts, if it is hotter it repels the ball. And Mr. Crookes' experiments showed him that whilst the action is in one direction in ordinary dense air, and in the opposite direction in a vacuum, there is an intermediate pressure at which heat produces no effect; and there is an intermediate pressure at which the critical point is passed, that the sign then changes, and instead of attraction there is then faint but unmistakeable repulsion; and as exhaustion increases repulsion continues to increase likewise. After discussing the explanations which may be given of these phenomena, and showing that they cannot be due to air currents, Mr. Crookes refers to the evidences we have in nature of this repulsive action of heat and attractive action of cold. He says that in that portion of the sun's radiation which we call heat, we have the radial repulsive force, possessing successive propagation, which is required to explain the phenomena of comets, and the shape and changes of the nebulæ, and to compare small things with great—to argue from pieces of straw up to heavenly bodies—it is not improbable that the attraction now shown to exist between a cold and a warm body will equally prevail, when for the temperature of ice is substituted the inconceivable cold of space; for a pith ball is substituted a celestial sphere, and for an artificial vacuum a stellar void. In the radiant molecular energy of cosmical masses, Mr. Crookes thinks may at last be found that "agent acting constantly according to certain laws," which Newton held to be the cause of gravitation.

In Mr. Crookes' second paper, read before the Royal Society last year, after describing some improved apparatus of great sensibility, he discusses the question of the action of a cold body, such as ice, on the suspended balance. As cold is simply the absence of heat and not a mode of motion at all, it is not very obvious at first sight how it can produce the opposite effect of heat. However, Mr. Crookes explains the matter very satisfactorily by Provost's "Law of Exchanges," and shows that attraction by a cold body is really repulsion by radiation following on the opposite side. Provost showed that all bodies not absolutely cold are always radiating heat, even when no cold body is there to receive it. A cold body has no power of acting on hot bodies at a distance, and causing them to begin to emit radiations, nor has a hot body any power of stopping the radiations from another hot body near it. Radiation, in fact, is always taking place, even when all the neighbouring bodies are at an equal temperature. In the case before us, one side of the vacuum chamber, and the air near it, are chilled by the ice, which, therefore, checks radiation on to the balance from that side, while radiation is still going on from the other, and, acting on the opposite side of the balance, causes it to rotate the reverse way.

Mr. Crookes then goes on to describe numerous experiments made for the purpose of ascertaining whether the attraction by heat, which is greater as the enclosed air around the balance approaches the normal density, increases still

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further; and in the same ratio if the apparatus is filled with air *above* the atmospheric pressure. And this he found to be the case, which is very much what we should expect *à priori*.

Shortly after Mr. Crookes' first paper on the subject was published, or at least when these interesting phenomena became generally known, Professor Osborne Reynolds propounded an explanation, which, if true, would at once deprive them of almost all their scientific interest. His explanation is this. It is, he says, impossible to produce a perfect vacuum; there must be always some slight residuum of gas remaining; and clinging to the surfaces, which no power can remove; and he believes that the movements of the balance are due to evaporation and condensation of the remaining gas upon the surfaces. Evaporation from a surface is attended with a force tending to drive the surface back; and condensation, with a force tending to draw the surface forward. In opposition to this theory of Professor Reynolds, we have certain facts established by Mr. Crookes' previous experiments, which are inconsistent with this theory of Professor Reynolds. Thus Mr. Crookes found that whether he started with the apparatus full of air, carbonic acid, water, iodine, hydrogen, ammonia, or whatever it might be, when he reached the point of highest rarefaction there was not found any difference in the results, which can be traced to the original gas. A hydrogen vacuum appears the same as a water or an iodine vacuum. Again it appears that the repulsion produced by the heat of a flame is not caused only by those rays usually called heat-rays, *i.e.*, the extreme or ultra red of the spectrum. Experiments were tried with the solar spectrum, and that of the electric light, by means of a train of quartz prisms, which prove the action on the balance to be also exerted by the luminous and ultra violet rays. This single fact that light rays of themselves (all heat rays having been rigorously excluded) are sufficient to cause a powerful action upon the balance, seems quite enough to overthrow Professor Osborne Reynolds's hypothesis. But Mr. Crookes undertook a further experiment with this special object; he had an apparatus blown from a thick and strong green glass such as they use for steam-boiler gauges, very difficult to fuse; in it was a thin bar of aluminium supported by a long platinum wire; the apparatus was sealed by fusion to the Sprengel pump, and exhaustion was kept going on for two days, until an induction-spark refused to pass across the vacuum. During this time the bulb and its contents were several times raised to a dull red heat. At the end of two days exhaustion, the tube was found to behave in the same manner as with his previous apparatus, viz., the aluminium bar was repelled by heat of low intensity, and attracted by cold. A similar experiment was next tried, only water was placed in the bulb before exhaustion. The water was then boiled away *in vacuo*, and the exhaustion continued, with frequent heating of the apparatus to dull redness for about 48 hours; at the end of this time the bar of aluminium was found to behave the same as the one in the former experiment, being repelled by heat. It is impossible to conceive that in these experiments sufficient gas or vapour was present to produce the effects Professor Reynolds ascribes to it. After the repeated heating to redness at the highest obtainable exhaustion, it is impos-

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sible that sufficient vapour or gas should condense on the surface of the balance to be instantly driven off by the warmth of the finger, with recoil enough to drive backwards a heavy piece of metal.

Since these experiments were made, Mr. Crookes has examined more fully the action of radiation on black and white surfaces. At the highest exhaustion heat appears to act almost equally on white and lamp-blacked pith, repelling them in about the same degree. The action of light, however, is different; these rays repel the black surface more energetically than they do the white surface. Taking advantage of this circumstance, Mr. Crookes has constructed an instrument which he calls a radiometer, very similar to those you see before you, except that instead of metal discs he used pith. This instrument rotates under the influence of both heat and light rays, the rapidity of rotation being in proportion to the intensity of the incident rays.

At the close of the paper the instrument was further illustrated by experiments conducted by the rev. lecturer and by Mr. G. H. With.

METEOROLOGICAL RECORDS FOR 1875;

Being the Monthly Returns sent to the *Hereford Times* during that year.

These Readings are corrected for temperature and error of instrument, but they are not reduced to sea-level. The height of the barometer-cistern above sea-level is 187 feet.

JANUARY.

The mean of all the 9 a.m. barometrical readings for January is 29·673 inches.

The highest reading (30·427 inches) was registered on the 30th, and the lowest (28·873 inches) on the 24th.

The mean temperature for January is, this year, 44·6 degrees, Mr. Glaisher's average temperature for this month being 36·9 degrees.

The highest reading of the thermometer in shade (55·8 degrees) was registered on the 19th, and the lowest (30·1 degrees) on the 22nd.

The mean degree of humidity for January, this year, is 89.9, complete saturation being 100.

The rainfall amounts to 3·64 inches, the greatest fall in 24 hours (0·62 inch) occurring on the 23rd.

There were 25 days on which 0·01 inch or more fell.

The winds at 9 a.m. daily were as follows:—N. 0; N.E. 2; E. 1; S.E. 9; S. 10; S.W. 6; W. 2; N.W. 1.

On the 24th there was a remarkable depression of the barometer, and a great gale of wind from W. and W.S.W., with vivid flashes of lightning during the night.

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FEBRUARY.

The mean of all the 9 a.m. barometrical readings during the month is 29·855 inches.

The highest reading (30·320 inches) was registered on the 16th, and the lowest (29·206 inches) on the 24th.

The mean temperature of February, this year, is 35·5 degrees, Mr. Glaisher's average for the month being 38·7 degrees.

The highest reading of the thermometer in shade (60·1 degrees) was registered on the 15th, and the lowest (23·0 degrees) on the 5th.

The rainfall amounted to 2·13 inches, the greatest fall in 24 hours occurring on the 6th. The snow on the 19th was equal to 0·13 inch of rainfall, that on the 20th to 0·30 inch, and that on the 24th to 0·385 inch. The measurement for the 25th, partly snow, and partly rain, amounted to 0·39 inch.

There were 11 days on which 0·01 inch or more of rain (or snow) fell.

The winds at 9 a.m. daily were as follows :—N. 2; N.E. 7; E. 1; S.E. 7; S. 1; S.W. 2; W. 1; N.W. 2; calm or uncertain, 5.

MARCH.

The mean of all the 9 a.m. barometrical readings during the month is 29·975 inches.

The highest reading (30·450 inches) was registered on the 18th, and the lowest (29·456 inches) on the 6th.

The mean temperature of March, this year, is 41.0 degrees, Mr. Glaisher's average for this month being 41·7 degrees.

The highest reading of the thermometer in shade (63·0 degrees) was registered on the 31st, and the lowest (25·0 degrees) on the 21st.

The mean degree of humidity for March, this year, is 84·7, complete saturation being 100.

The rainfall amounts to 1·067 inches, the greatest fall in 24 hours (0·365 inches) occurring on the 5th. Melted snow amounted to 0·05 inch on the 2nd.

There were 11 days on which 0·01 inch or more of water was deposited in the rain-gauge.

The winds at 9.0 a.m. daily were as follows :—N. 4; N.E. 10; E. 2; S.E. 2; S. 1; S.W. 6; W. 1; N.W. 4.

APRIL.

The mean of all the 9 a.m. barometrical readings for April is 29·896 inches.

The highest reading (30·411 inches) was registered on the 1st, and the lowest (28·963 inches) on the 5th.

The mean temperature for April is, this year, 47·1 degrees, Mr. Glaisher's average temperature for this month being 46·2 degrees.

The highest reading of the thermometer in shade (76·1 degrees) was registered on the 20th, and the lowest (27·1 degrees) on the 23rd.

The mean degree of humidity for April, this year, is 82·6, complete saturation being 100.

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The rainfall amounts to 0·852 inches, the greatest fall in 24 hours (0·195 inch) occurring on the 9th.

There were 10 days on which 0·01 inch or more fell.

The winds at 9.0 a.m daily were as follows :—N. 2 ; N.E. 8 ; E. 4 ; S.E. 4 ; S. 3 ; S.W. 3 ; W. 1 ; N.W. 4.

MAY.

The mean of all the 9 a.m. barometrical readings during the month of May is 29·816 inches.

The highest reading of the barometer during the month (30·198 inches) was registered on the 11th, and the lowest (29·290 inches) on the 7th.

The mean temperature of May, this year, is 55·4 degrees, Mr. Glaisher's average temperature for the month being 52·9 degrees.

The highest reading of the thermometer in shade (83·0 degrees) was registered on the 14th, and the lowest (39·1 degrees) on the 30th.

The mean degree of humidity for the month is 80·8, complete saturation being 100.

The rainfall amounts to 2·868 inches. There was a deposit of water in the rain-gauge to the amount of 0·01 inch, or more, on 14 days. On the 28th there was a fall of 0·962 inch ; this was the greatest quantity which fell in 24 hours during May.

The winds at 9.0 a.m. were as follows :—N. 2 ; N.E. 1 ; E. 3 ; S.E. 4 ; S. 5 ; S.W. 7 ; W. 2 ; N.W. 7.

JUNE.

The mean of all the 9 a.m. readings during the month of June is 29·711 inches.

The highest reading of the barometer during the month (30·066 inches) was registered on the 24th, and the lowest (29·106 inches) on the 15th.

The mean temperature of June, this year, is 58·5 degrees, Mr. Glaisher's average temperature for the month being 59·1 degrees.

The highest reading of the thermometer in shade (84·5 degrees) was registered on the 3rd, and the lowest (40·7 degrees) on the 22nd.

The mean degree of humidity for the month is 79·0, complete saturation being 100.

The rainfall amounts to 2·491 inches. There was a deposit of water in the rain-guage to the amount of 0·01 inch or more on 17 days. On the 28th there was a fall of 0·510 inch ; this was the greatest quantity which fell in 24 hours during June.

The winds at 9.0 a.m. were as follows :—N. 2 ; N.E. 6 ; E. 0 ; S.E. 2 ; S. 3 ; S.W. 7 ; W. 2 ; N.W. 6 ; uncertain, 2.

JULY.

The mean of all the 9 a.m. barometrical readings during the month is 29·784 inches.

The highest reading (30·179 inches) was reigstered on the 27th, and the lowest (29·265 inches) on the 11th.

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The mean temperature of July, this year, is 57·8 degrees, Mr. Glaisher's average for the month being 61·8 degrees.

The highest reading of the thermometer in shade (81·7 degrees) was registered on the 29th, and the lowest (41·2 degrees) on the 26th.

The mean degree of humidity is 79·0, complete saturation being 100.

The rainfall amounted to 4·834 inches, the greatest fall in 24 hours (2·387 inches) occurring on the 14th. There were 19 days on which 0·01 inch or more fell.

The winds at 9.0 a.m. daily were as follows :—N. 4; N.E. 8; E. 0; S.E. 2; S. 3; S.W. 1; W. 4; N.W. 6; uncertain, 3.

AUGUST.

The mean of all the 9. a.m. barometrical readings during the month is 29·842 inches.

The highest reading (30·167 inches) was registered on the 21st, and the lowest (29·534 inches) on the 10th.

The mean temperature of August this year is 62·4, Mr. Glaisher's average for the month being 61·2 degrees.

The highest reading of the thermometer in shade (85·1 degrees) was registered on the 16th, and the lowest (42·4 degrees) on the 21st.

The mean degree of humidity is 81·4, complete saturation being 100.

The rainfall amounted to 1·705 inch,-the greatest fall in 24 hours (0·510 inch) occurring on the 8th. There were 16 days on which 0·01 inch or more fell.

The winds at 9 a.m. daily were as follows :—N. 4; N.E. 2; E. 3; S.E. 5; S. 3; S.W. 3; W. 4; N.W. 6.

SEPTEMBER.

The mean of all the 9 a.m. barometrical readings during the month is 29·838 inches.

The highest reading (30·164 inches) was registered on the 12th, and the lowest (29·427 inches) on the 27th.

The mean temperature of September this year is 58·54 degrees, Mr. Glaisher's average for the month being 56·6 degrees.

The highest reading of the thermometer in shade (79·1 degrees) was registered on the 7th, and the lowest (40·2 degrees) on the 29th.

The mean degree of humidity is 86·6, complete saturation being 100.

The rainfall amounted to 3·580 inches, the greatest fall in 24 hours (0.735 inch) occurring on the 23rd. There were 19 days on which 0·01 inch or more fell.

The winds at 9 a.m. were as follows :—N. 1; N.E. 6; E. 4; S.E. 1; S. 6; S.W. 3; W. 4; N.W. 3; two days uncertain.

OCTOBER.

The mean of all the 9 a.m. barometrical readings during the month is 29·569 inches.

The highest reading (30·203 inches) was registered on the 6th, and the lowest (29·018 inches) on the 13th.

The mean temperature of October this year is 47·89 degrees, Mr. Glaisher's average for the month being 50·2 degrees.

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The highest reading of the thermometer in shade (68·6 degrees) was registered on the 5th, and the lowest (31·6 degrees) on the 13th.

The mean degree of humidity is 89·6, complete saturation being 100.

The rainfall amounted to 5·173 inches, the greatest fall in 24 hours (1·060 inch) occurring on the 9th. There were 23 days on which 0·01 inch or more fell.

The winds at 9 a.m. were as follows:—N. 1; N.E. 10; E. 2; S.E. 5; S. 2; S.W. 3; W. 3; N.W. 4; one day uncertain.

NOVEMBER.

The mean of all the 9 a.m. barometrical readings during the month is 29·610 inches.

The highest reading (30·060 inches) was registered on the 22nd, and the lowest (28·620 inches) on the 10th.

The mean temperature of November this year is 41·8 degrees, Mr. Glaisher's average temperature for November being 43·2 degrees.

The highest reading of the thermometer in shade (60·7 degrees) was registered on the 4th, and the lowest (28 degrees) on the 26th.

The mean degree of humidity is 86, complete saturation being 100.

The rainfall amounted io 4·491 inches, the greatest fall in 24 hours (0·91 inch) occurring on the 13th. There was a fall of 0·837 inch on the 9th, and another of 0·725 inch on the 5th. There were 22 days on which 0·01 inch or more fell.

The winds at 9 a.m. daily were as follows:—N. 3; N.E. 7; E. 1; S.E. 5 S. 1; S.W. 4; W. 2; N.W. 6; one day uncertain.

DECEMBER.

The mean of all the 9 a.m. barometrical readings during the month is 29·882 inches.

The highest 9 a.m. reading (30·314 inches) was registered on the 28th, and the lowest (29·328 inches) on the 22nd.

The mean temperature of the month was 39·7 degrees, Mr. Glaisher's average temperature for December being 39·8 degrees.

The highest reading of the thermometer in shade (55·2 degrees) was registered on the 21st, and the lowest (23 degrees) on the 6th.

The mean degree of humidity was 89, complete saturation being 100.

The rainfall amounted to 1·625 inches, the greatest fall in 24 hours 0·850 inch) was measured on the morning of January 31st, and so goes to the credit of December 31st. In this fall there was snow as well as rain. The rain fell first. There were 11 days on which 0·01 inch or more fell.

The winds at 9. a.m. daily were as follows:—N. 2; N.E. 3; E. 0; S.E. 4; S. 5; S.W. 7; W. 3; N.W. 6; one day uncertain.

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METEOROLOGICAL NOTES FOR THE YEAR 1875.

The mean of all the 9 a.m. barometrical readings for the year 1875 is 29·788 inches.

The highest reading during the year (30·450) was registered on March 18th, and the lowest (28·620) on November 10th.

The mean temperature of 1875 is 49·1 degrees, Mr. Glaisher's average temperature for the year (at Greenwich) being 49·02 degrees.

The highest reading of the thermometer in shade during the year 1875 (85·1 degrees) was registered on August 16th, and the lowest (23 degrees) on February 5th and December 6th.

The mean degree of humidity for the whole year is 85·4, complete saturation being 100.

The rainfall amounted to 34·461 inches at 6 feet from the ground. At one foot from the ground the total was 35·801 inches. The greatest fall in 24 hours (2·387 inches) occurred on the 14th of July. This is the largest amount I have ever measured for the same space of time at Hereford. At Ross Mr. Southall measured 2·98 inches; at Bryngwyn Mr. Rankin measured 3·11 inches; and at Whitfield Mr. Wheatley measured 3·26 inches on the same day. The 14th of July may therefore be accounted one of the wettest days, if not the very wettest day, recorded by Herefordshire observers.

The amount of rainfall for 1875, though considerable, at least in this part of England, fell very short of the amount of rainfall during 1872. In 1872, my gauge at 6 feet from the ground collected 42·26 inches, and the gauge in Mr. Davison's nursery gardens, at one foot from the ground, collected 44·50 inches. At Rocklands, the gauge at 1 foot 10 inches from the ground collected 48·68 inches; at Burcher Cottage, near Kington, the gauge at 2 feet 8 inches from the ground collected 49·54 inches; and at Leysters (the highest gauge in the county) the gauge at 4 inches from the ground collected 54·03 inches.

These last-named gauges, it must be understood (Rocklands and Burcher Cottage at all events), always collect more rainfall than the gauges in the neighbourhood of Hereford.

From a calculation kindly made for me by a friend (the figures used being taken from my own records) it appears that the months with us stand in the following order as to their relative amount of wetness:—

Monthly Means of Rainfall for ten years—1866 to 1875.

		Inches.			Inches.
1.	September	3·654	7.	February	2·200
2.	January	3·365	8.	August	2·159
3.	October	2·944	9.	May	1·874
4.	December	2·525	10.	March	1·870
5.	July	2·396	11.	June	1·755
6.	November	2·343	12.	April	1·634

Yearly mean of rainfall for 10 years—28·719 inches.

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I believe I lose about two inches of rainfall in the year by placing my gauge so high; but I am compelled to do this in order to escape the shelter of the garden wall.

From the averages given above it would appear that the yearly mean rainfall at Hereford is about 30 inches and a few tenths, and that the average amount of rainfall for this city which we have hitherto accepted (the result of the late Mr. Lawson's records) is below the truth. Very possibly Mr. Lawson's gauges were injuriously sheltered by trees and walls. The gauges stood 4 feet from the ground.

At Burcher Cottage the mean rainfall for 30 years is 31·66 inches, and at Rocklands the mean for 21 years is 31·79 inches.

The winds at 9 a.m. daily during the year were as follows:—N. 27 days; N.E. 70; E. 21; S.E. 50; S. 43; S.W. 52; W. 29; N.W. 55; and 18 days calm or uncertain.

My meterological friends will kindly take notice that my public weather records end with these notes for the past year. Dr. Chapman has now commenced meteorological observations at Burghill, in connection with the Meteorological Society, and as his instruments are of the best, and his situation the very best, he will, I have no doubt, be able to do much better than I have done. I am happy, however, to be able to say that since my return to Hereford, in 1866, we (at Richmond Place) have not suffered a single day to escape us.

January 22, 1876.

EDWIN J. ISBELL.

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RAINFALL OF HEREFORDSHIRE.

1875.	Longtown. 8 inches from the ground.	Lynhales. 1 foot from the ground.	Whitfield. 6 inches from the ground.	Rocklands. 1 ft. 10 ins. from the ground.	Bryngwyn. 10 inches from the ground.	Staunton-on Wye. 1 ft. 1 in. from the ground.	West Malvern. 1 ft. 6 ins. from the ground.	Stoke Bliss. 1 ft. 2 ins. from the ground.	Much Marcle. 3 feet from the ground.	Bromyard. 8 inches from the ground.	Fownhope Vicarage. 1 ft. 1 in. from the ground.	Ledbury, West Bank. 1 foot from the ground.	Wigmore. 10 inches from the ground.	Hereford, Richmond Place 5 ft. 8 ins. from the ground.	Hampton Court. 1 ft. 4 ins. from the ground.	Leysters' Vicarage. 6 inches from the ground.
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
January	6·41	4·40	4·95	5·24	4·93	4·39	4·11	3·23	3·90	3·70	4·27	3·51	3·82	3·64	3·60	3·37
February.....	2·72	2·41	2·29	2·15	1·79	2·41	1·43	2·24	1·77	2·00	2·22	1·98	2·04	2·13	1·92	*
March	1·71	*	1·40	1·40	0·93	1·45	1·06	0·94	0·94	1·01	0·91	0·89	0·88	1·06	1·12	*
April	2·01	1·55	1·28	2·50	*	1·11	1·21	1·06	1·28	0·88	1·08	1·21	1·14	0·85	0·84	0·98
May	2·75	2·14	2·95	2·42	3·08	2·41	3·01	2·90	2·44	2·99	2·67	2·42	2·47	2·86	2·54	3·31
June	4·78	*	3·65	3·03	3·64	3·86	2·74	2·41	2·61	2·57	3·31	2·46	3·54	2·49	2·22	3·18
July	7·23	*	6·68	*	6·99	4·95	7·49	6·31	6·97	5·26	5·99	7·05	4·71	4·83	4·18	6·14
August.....	2·02	5·77	1·95	*	*	2·70	2·00	3·91	2·15	2·48	1·77	1·65	3·69	1·70	2·94	3·35
September ...	4·72	4·56	4·28	3·31	3·77	4·55	3·33	3·36	3·39	3·32	3·08	3·14	3·05	3·58	3·56	3·45
October	8·02	6·75	6·01	5·92	5·90	6·31	8·18	5·92	5·63	6·71	5·39	5·91	5·63	5·17	5·42	6.22
November ...	7·65	5·41	5·57	5·70	5·69	5·69	4·91	4·06	5·02	4·99	5·17	4·96	4·24	4·49	4·17	4·44
December ...	2·94	1·20	2·14	1·71	1·93	1·65	0·96	1·67	1·73	1·79	1·59	0·95	0·73	1·62	1·47	1·69
Totals.....	52·86	43·76	43.15	42·16	41·69	41·48	40·43	38·01	37·83	37·70	37·45	36·13	35·94	34·42	33·98	31·76
	†52·90	†43·66							†37·81		†37·55			†34·46		

To the above may be added the following totals for the year 1875:—(the monthly totals for these stations were omitted in consequence of the non-appearance of monthly returns, in the *Hereford Times*, during the first quarter) Goodrich 39·70; The Graig, Ross, 38·57; Sellack Vicarage 37·15; Stretton 36·91; Hagley Park 35·82; Davison's Nursery 35·80; Tupsley 33·88; Leominster 33·86; Credenhill Court 33·14.

* No returns for the *Hereford Times*.

† Symons's Rainfall.

EDWIN J. ISBELL.

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THE RAINFALL FOR THE COUNTY OF HEREFORD DURING THE YEAR 1874, BY THE REV. NASH STEPHENSON.

There are now 21 observers at stations fairly distributed over the county who, with almost unfailing regularity, transmit to the *Hereford Times* for publication the monthly amount of rain at their different stations. As Mr. Symons remarks in his annual report of 1873 : "No county has so rapidly taken a foremost position in rainfall matters as Hereford. We are fortunate in having several able helpers in this county, and the cordial support of that giant of the provincial press, the *Hereford Times*."

By reference to the subjoined tables it will be seen that 21 observers recorded the total depth of the year's rain, and that the stations are placed according to the depth of rain which fell : the maximum fall heading the list. It is a long established fact that in mountainous districts heavy falls of rain are the rule. It cannot, therefore, be a matter of surprise that Longtown, nestling on the eastern breast of the Black Mountains, should enjoy the unenviable fame of having had the heaviest amount of rainfall during the past year, nor that Lynhales, which stands 566 feet above the sea, should follow next in order, nor that Leysters, which is credited with being 700 feet (?) above sea level, should attain the third place. To the broad rules of the distribution of rain exceptions are many and formidable, or it may be well asked why Rocklands, near Ross, which is only 98 feet above sea level, and Staunton-on-Wye, which is 255 feet, should occupy the third and fourth places, and take the precedence of Bryngwyn, which is 432 feet, and West Malvern, which is 850 feet altitude. The total fall at Longtown, which heads the list, was 35·71 inches, and at Ledbury, which closes the list, as in the preceding year, was 22·35 inches, the excess of the former over the latter being 13·36 inches. It is remarkable that the former is on the spur of the Black Mountains, and the latter on the spur of the Malvern range. The mean fall of all the stations is 26·57 inches, being 0·41 inch in excess of the returns of 1873, and 15·68 less than 1872; the wettest year for 40 years in the county of Hereford. The average of the rain in England from 1850 to 1856 was 34·72 inches. There was, therefore, a deficiency in last year of 8·15 inches from that average. The 26 inches which fell in the county pale into insignificance compared with what fell elsewhere. The greatest rainfalls reported to Mr. Symons in 1874 were 149·00 at Pen-y-gwrd, near Llanberris, and 148·79 inches at Seathwaite, in Westmoreland. To the uninitiated the term of "an inch of water" is hardly intelligible. It may be explained thus—When it is stated that in 1874 the total depth of rain which had fallen was 26 inches, it means that if the whole quantity of rain which had fallen in that year had remained where it fell, neither sinking in, nor running off, nor drying up, the ground would have been covered to the depth stated.

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RAINFALL AT STATIONS IN THE COUNTY OF HEREFORD DURING THE YEAR 1874.

	Name of Station.	Name of Observer.	Tl. dpth. in inches for the whole yr.	Greatest Fall 24 hours.		Days on which 01 or more fell.	Total rainfall in 1873.
				Depth.	Date.		
1	Longtown	C. L. Eagles	35·71	1·55	Sept. 30	142	—
2	Lynhales, near Kington	S. W. J. Robinson	31·38	1·40	Nov. 29	98	25.42
3	Leysters, near Tenbury	T. S. Hewitt	30·56	—	—	—	26·82
4	Rocklands, near Ross	J. M. Herbert	30·28	1·44	June 29	171	32·09
5	Staunton-on-Wye	H. W. Phillott	28·50	1·31	Sept. 30	178	24·37
6	Bryngwyn, near Hereford	J. Rankin	27·05	1·44	Sept. 30	156	26·94
7	West Malvern	A. H. Hartland	26·78	1·01	Feb. 26	—	26·58
8	Wigmore	E. Barton	26·44	1·00	Sept. 1	153	—
9	Whitfield	W. Wheatley...	26·39	1·65	Sept. 30	166	—
10	Ross (The Graig)	H. Southall	25·98	0.88	Feb. 26	180	27·54
11	Stretton Sugwas	H. Cooper Key	25·80	1·27	Sept. 30	153	23·98
12	Bromyard	Nash Stephenson	25·76	0·94	May 22	166	28·28
13	Stoke Bliss	G. E. Alexander	25·71	1·57	Nov. 28	156	—
14	Brockhampton, near Bromyard	E. J. Eling	25·59	1·00	Feb. 26	150	—
15	Caerswall, Much Marcle	T. Charles	24·79	1·01	Nov. 25	176	25·87
16	Hereford	E. J. Isbell	24·42	1·23	Sept. 30	190	25·46
17	Hampton Court, near Leominster ...	J. H. Arkwright	24·06	1·09	Sept. 30	153	—
18	Fownhope	T. West	23·84	0·83	Feb. 26	154	25·34
19	Hagley Park, near Hereford	A. Hutchinson	23·84	—	—	—	—
20	Tupsley, Hereford	P. Ballard	22·84	—	—	—	—
21	Ledbury (West Bank)	T. E. Wheatley	22.35	0·94	Feb. 26	149	22·46

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THE GREATEST FALL IN 24 HOURS.

The heaviest amount of rain that fell on any one day was at Whitfield on the 30th of September, on which 1·65 inches were recorded. Out of 18 returns of that month 10 concur in marking this day as the maximum fall. A like number have recorded the maximum fall during the year, and, of these, 7 have marked the 30th Sept., and 5 the 26th Feb., whilst the rest have severally marked May 22, June 29, Sept. 1, Nov. 25, 28, and 29. Snow fell on ten days during December, the heaviest on the night of the 13th; on the following morning it averaged 9 inches on the ground.

THE NUMBER OF RAINY DAYS IN THE YEAR.

Before classifying the rainy days let me explain what a rainy day means. A rainy day, in the parlance of rain-doctors, signifies a day on which 0·01 inch falls, that is to say, a day on which the smallest amount of rain, or mist, or snow is discovered in the gauge. In tabulating the 17 stations that have returned their number of rainy days, it will be found that they range themselves in the following order:—1, Hereford (190); 2, Ross, the Graig (180); 3, Staunton-on-Wye (178); 4, Much Marcle (176); 5, Ross—the Rocklands—(171); 6, Bromyard (166); 7, Whitfield (166); 8, Bryngwyn (156); 9, Stoke Bliss (156); 10, Fownhope (154); 11, Hampton Court, near Leominster (153); 12, Stretton Sugwas (153); 13, Wigmore (153); 14, Brockhampton, near Bromyard (150); 15, Ledbury (149); 16, Longtown (142); 17, Lynhales (98). The mean of all the stations will be found to 158 days; of 1873 it was 161.

It has been ascertained and stated that more rain fell at Longtown, and less rain at Ledbury, than at any other station, and hence it might be assumed that the inhabitants of the former parish must be living in a perpetually dismal atmosphere of mist and rain and cloud and storm, whilst the inhabitants of the latter parish were basking in perpetual sunshine and halcyon days. Such a conclusion is inconsistent with the logic of stern facts. The amount of rain which has fallen in a year in a locality by no means indicates the amount of rainy days in the year. There were actually more rainy days at Ledbury than at Longtown; and at the latter parish there were, with one exception, more rainless days than at any other parish from which returns have been made in the county of Hereford. Whether future observations will bear out this deduction from last year's experience is a question which has still to be solved. The city of Hereford heads the list for 1874, and it obtained like pre-eminence in the year preceding.

THE MONTHLY FALL.

The following list of mean monthly rainfall has been calculated by me from the printed returns together with other returns privately sent me: 1. September (4·27); 2. February (3·00); 3. August (2·85); 4. October (2.83); 5. January (2·60); 6. November (2·58); 7. December (2·38); 8. April (1·74); 9. May (1·15); 10. March (0·93); 11. July (0·92); 12. June (0·91).

It would thus appear that September had the maximum and June the minimum rainfall, whilst April and July, which are usually debited as the rainest

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months, have fallen to the eighth and eleventh ranks. As far as present investigations have gone, it is impossible to lay down any general law as to the precise months of maximum and minimum rainfall, but during the last decade of years "April has been the driest month at most stations in the British Isles, while in the previous decade this distinction was pretty generally shared by February and May." It is noteworthy that whilst in the first four months of the year the mean fall was 8·27, and in the second four months it was 5·83 : in the last four months it reached 12·06 inches. As the yield of our wells and streams mainly depends on our autumnal rains it is satisfactory to find that they were greatly in excess of the downfall in the other divisions of the year, and that there is little cause to anticipate any deficiency during the present year. Our hopes are further strengthened by finding that January of the present year has yielded a mean fall of 4·14 inches, which is within 0·13 inch of the rainiest month of 1874.

Before closing my report I desire to express my indebtedness to Mr. Isbell, for the altitudes of many of the Hereford stations.

THE RAINFALL FOR THE COUNTY OF HEREFORD DURING THE YEAR 1875, BY THE REV. NASH STEPHENSON.

There is now a permanent staff of twenty observers, who with almost unfailing regularity, send to you for publication the monthly record of the rainfall in their several localities. These twenty stations are so evenly scattered over the county that, with the exception of a station needed near Weobley, and one near Withington, which will be filled shortly by Mr. Higgins, of Thinghill, and one near Shobdon, the whole area is fairly and sufficiently represented. Additions near to existing stations are of little use, for they serve only the minor purpose of confirming the accuracy of old stations.

HEIGHT ABOVE SEA LEVEL.

During the past year the monthly returns have been rendered much more complete and scientific by the insertion in all cases of the diameter of the guage and its height above the ground, and with three exceptions, the height above sea level. The three excepted stations are Longtown, Hampton Court, and Wigmore.

ON THE MONTHLY FALL OF RAIN IN 1875.

On examining the subjoined Table A. it will be found that the rotation of months according to rainfall would be classified thus :—1, October ; 2, November ; 3, January ; 4, September ; 5, June ; 6, July ; 7, May ; 8, August ; 9, February ; 10, December ; 11, April ; and 12, March. The rainfall in October, which heads the list, was above the average in nearly all parts of England, and in Herefordshire it was specially so at West Malvern (8·18), Longtown (8·02), Lynhales (6·75), and Staunton-on-Wye (6·31). The minimum monthly rainfall this year occurred in April and March. It is singular that April, which is associated in our minds with rain, should prove to be nearly the driest month of the last two years in Herefordshire, and that during the last decade of years it has also proved to have been so at most stations in the British Isles. This year February holds the ninth rank, last

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year it held the second. In olden times fine weather in this month was held to be most prejudicial.

"All the months in the year
Curse a fair Februeer."

"The Welchman had rather see his dam on the bier
Than to see a fair Februeer."

According to the experience of Mr. Isbell the monthly means in Hereford for the last ten years would range as follows :—1st September, 2nd January, 3rd October, 4th July, 5th December, 6th November, 7th February, 8th August, 9th May, 10th March, 11th June, and 12th April.

The amount of rain that has fallen in the year has been very unequally distributed. In the first four months there fell 8·45 ; in the next four months 11·22; and in the last four months 16·40 inches. If the months are ranged according to the number of rainy days it will be found that they follow thus :—March, April, December, February, May, August, June, July, September, November, October, and December. This order presents to us this strange phenomenon. The months in which the heaviest amount of rain fell had the fewest rainy days; and this rule of inverse ratio obtains with almost unfailing exactness throughout the whole twelve months. The driest months are thus the months in which occurred the most rainy days.

TABLE A.

Comparison of the mean Monthly Rainfall in 1875, with the mean Monthly Rainfall in previous years.

	1875.	1874.	1873.	
January	4·14	2·60	3·44	
February	2·03	3·00	1·45	
March	1·08	0·93	3·15	
April	1·20	1·74	0·98	
May	2·68	1·15	2·14	
June	3·09	0·91	2·83	
July	2·91	0·93	2·60	
August	2·54	2·85	3·29	
September	3·68	4·27	1·57	
October	6·07	2·83	1·84	
November	5·06	2·58	1·93	
December	1·59	2·38	0·65	

THE GREATEST FALL IN TWENTY-FOUR HOURS.

There exists little difficulty in dealing with the past year in naming the day on which occurred the heaviest daily rainfall in our country. In many parts of the country violent storms and terrific gales broke out on the 14th of November, but the most violent storms and gales appear to have burst out on the 19th of that month, and to have caused in some localities almost irreparable damage to shipping and houses and property. The path of this violent storm is not easily to be traced, but from the accounts published in the *Times*, it would appear that at North Shields, Hull, Cardigan, St. Andrews, Aberdeen, Hastings, and in the valley of

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the Thames, and in other places the disastrous floods of the 19th of November, would seem to have burst with unwonted severity. Mr. Symons states that the nearest parallel was probably the "Duke of Wellington's flood, namely, that which occurred during the Lying-in-state, &c., in November, 1852." Of this flood I still retain a vivid recollection. In the low lands on the London side of Oxford, for some short distance, and some short time, the trains had to be conveyed by horse power, and the train that conveyed me to London happened to be the first train that passed by steam power on the subsidence of the flood. But of these floods of the 14th and 19th of November we, of Herefordshire, personally knew nothing. The maximum daily fall in that month was only 1½ inches at Rocklands, and that is dated as happening on the 13th. With the exception of Lynhales, to which I will presently allude, every station in our county agrees in naming the 12th of July as the day of the maximum annual fall. At the seventeen stations, with the exception of Hampton Court (1·57) the fall exceeded two inches; whilst at Malvern West the fall was 3·12, at Whitfield, 3·26, at Rocklands, 3·36, and at Longtown it was 3·88. This is the most important rain that has been recorded in this county for many years, and perhaps Mr. Isbell will tell us when last it had its parallel. Some interesting details have been given us of this remarkable storm, or rather steady downfall of rain.

HEREFORD.—Mr. Isbell states that his measurement of 2·39 inches, was the largest amount he had ever measured at Hereford.

ROSS, THE GRAIG.—Mr. Southall states that the fall with him was by far the largest amount since August 13, 1858, when he had 3·84 inches in the 24 hours, and then the circumstances (a sort of waterspout) were different.

BROMYARD.—Continuous rain fell the whole of the 14th and 15th, day and night, and the readings of the two days were 2·42 and 0·66 respectively.

LONGTOWN.—Mr. Eagles says that it began to rain on July 13th at 6.30 a.m., and never ceased till 12.30 a.m. on the 15th, during which time 4·91 inches fell. During the months we had 7·21 in 13 days.

LYNHALES.—On the 14th of July, says Mr. Robinson, we had 1·83, but on the 12th of August we had a severe thunderstorm, almost a waterspout, and in two hours we measured two inches, and in the 24 hours 2·28 inches. The storm was very local on this occasion, as in the neighbouring parish of Titley they had scarcely any rain.

THE TOTAL RAINFALL OF THE COUNTY DURING THE YEAR 1875.

There can be no doubt that the year just past was pre-eminently a season of heavy rainfalls, and destructive floods, of great storms at sea, and consequent wreckage and loss of life. The hay crops, though large in quantity, were badly gathered in, but the cereal and other crops, though not equal to the best years, were good beyond the general expectation. The reports that have been forwarded from foreign countries all seem to indicate that there has prevailed "a plague of waters." It must not, however, thence be assumed that there has been over the globe an exceptionally wet year. The inhabited parts of the earth form only a

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small portion of its surface, and of what occurs in the remainder we are in ignorance. It is quite possible that year by year there falls the same quantity of rain, but that it is precipitated unequally, and that while some portions of the earth's surface suffer from a plethora of rain other portions suffer from drought.

On reference to table B. it will be seen that nineteen stations have recorded the depth of rain that fell throughout the year. The maximum fall was at Longtown, where the large quantity of 52·86 inches were registered. Last year the same station obtained a like pluvial pre-eminence, and, looking to the locality, it is quite probable that in future years it will equally head the list. The minimum fall appears to have been at Brockhampton, near Bromyard; at which station was recorded 31·37 inches, or 21·49 inches less than at Longtown. That so small a quantity should have fallen at Brockhampton is to me unaccountable. It is situated 110 feet higher than Bromyard, and therefore should register 4 per cent. more; it is near to the summit of Bromyard Downs, and yet, notwithstanding, the depth has been less by 6·33 inches than what was recorded at Bromyard.

The mean rainfall of all the stations for the year was 38·72; of all the stations for 1874 the mean was 26·57; and of 1873 it was 26·16 inches. The wettest year for 40 years in the county of Hereford was 1872, when the total was 42·25, so that the year 1875 was only 3·53 inches less than 1872. Mr. Isbell calculates 30 inches and two or three tenths to be the real mean for Herefordshire, and Mr. Symons calculates 34·92 as the average of England from 1850 to 1865.

THE NUMBER OF RAINY DAYS IN THE YEAR.

In Table B is given the number of days on which ·01 or more fell in the year at eighteen of the nineteen stations. In order to simplify the subject it will be as well to tabulate the stations according to the number of rainy days; the maximum heading the list. 1 Hereford; 2 Bromyard; 3 Whitfield; 4 Much Marcle; 5 Malvern West; 6 Staunton-on-Wye; 7 Ross, Graig; 8 Wigmore; 9 Bryngwyn; 10 Fownhope; 11 Stoke Bliss; 12 Rocklands; 13 Hampton Court; 14 Longtown; 15 Lynhales; 16 Stretton Sugwas; 17 Ledbury; 18 Brockhampton.

It is somewhat singular that Hereford, which ranks sixteenth according to the depth of rain, should enjoy the somewhat unenviable priority of having more rainy days than any other place in the county, and that this should be the third year in succession in which it has headed the list. It is also somewhat singular that Longtown and Lynhales which stand first and second, according to the depth of rain, should have had a like number of rainy days in the year, and should stand so low down as 15 out of the 18 stations. The same noticeable contrast between Brockhampton and Bromyard, remarked upon in the depth of rain, obtains here also. Bromyard stands second on the list with 192 days, whilst Brockhampton stands last on the list with a minimum of 146 days. The mean of all the stations will be found to be 174 rainy days in the year; of 1874 it was 158, and of 1873 it was 161 rainy days.

In taking a retrospect of the year that is past the unthinking observer might be inclined to reflect only on the excess of rain that had fallen, and on the

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consequent obstruction and inconvenience he had experienced in his out-door amusements and occupations. The beneficent Creator of all ever tempers judgment with mercy and makes all things collectively work together for the weal of His creatures. It would be well, therefore, for us all to recollect that the unwonted supply of rain filled our wells, and purified our water, and cleared our atmosphere, and increased the fruits of the earth, and infused health and strength into many that were sick and waning, and told most favourably on the tables of mortality. In the words of the Church we may well beseech our most merciful Father to continue to send us such moderate rain and showers that our land may continue to yield us her fruits of increase to His glory and our comfort.

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TABLE B.

Comparison of the Yearly Rainfall in 1875 at the different Stations, with the Yearly Rainfall of previous Years.

No.	Stations.	Authorities.	Rain Guage.			Depth of Rain.			Days on which ·01 or more fell, 1875.	Greatest fall in 24 hours. 1875.	
			Diameter.	Height above Ground.	Height above Sea Level.	1875.	1874.	1873.		Depth.	Date.
				ft. in.	feet.						
1	Longtown	C. L. Eagles	5	0 8	...	52·86	35·71	...	159	3·88	July 14
2	Lynhales...	S. Robinson	8	1 0	566	43·76	31·38	25·42	159	2·28	Aug. 12
3	Whitfield...	W. Wheatly	5	0 6	427	43·15	26·39	...	190	3·26	July 14
4	Rocklands	J. M. Herbert ...	8	1 10	97	42·16	30·28	32·09	173	3·36	,,
5	Bryngwyn	J. Rankin	5	0 10	420	41.69	27·05	26·94	177	3·11	,,
6	Staunton-on-Wye ...	H. W. Phillott ...	5	1 0	255	41·48	28·50	24·37	185	2·40	,,
7	Malvern (West)... ...	A. H. Hartland ...	8	1 6	850	40·43	26·78	26·58	186	3·12	,,
8	Ross, Graig	H. Southall	5	1 0	200	38·57	25·98	27·54	185	2·98	,,
9	Stoke Bliss	G. E. Alexander ...	5	1 2	400	38·01	25·71	...	175	2·45	,,
10	Much Marcle	T. Charles	5	3 0	423	37·83	24·79	25·87	188	2·54	,,
11	Bromyard	Nash Stephenson ...	8	0 8	440	37·70	25·76	28·28	192	2·42	,,
12	Fownhope	T. West	5	1 1	192	37·55	23·84	25·34	176	2·38	,,
13	Stretton Sugwas ...	H. C. Key	5	1 0	200	36·91	25·80	23·98	152	2·52	,,
14	Ledbury	T. E. Wheatley ...	5	0 6	410	36·13	22·35	21·46	150	2·78	,,
15	Wigmore...	E. Barton	5	0 10	...	35·94	26·44	...	183	2·28	,,
16	Hereford	J. Isbell	8	5 8	188	34·46	24·42	25·46	198	2·38	,,
17	Hampton Court... ...	J. H. Arkwright ...	8	1 4	...	33·98	24·06	...	160	1·87	,,
18	Leysters	T. S. Hewitt	5	0 6	702	31·76	30·56	26.82	...	...	...
19	Brockhampton, near Bromyard	J. Eling	8	0 8	550	31·37	25·59	...	146	2·42	July 14

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THE WYE.

Register of height of River in the year 1875, taken at Hereford Bridge at 9 a.m.
The datum point is the summer level of the river.

1875.	No. of days wet or Stormy	No. of days dry.	Height of river above summer level		Average height each day.		No. of days of low water.	OBSERVATIONS.				
			Feet.	Ins.	Feet.	Ins.					Feet.	Ins.
January	9	22	110	3	3	$6\frac{3}{4}$	0	Height of River on		3rd	12	,,
February.....	19	9	48	0	1	$8\frac{1}{2}$	0	,,	,,	7th	4	,,
March	10	21	58	8	1	$10\frac{3}{4}$	0	,,	,,	7th	12	,,
April	7	23	32	1	1	$0\frac{1}{4}$	0	,,	,,	5th	4	,,
May	9	22	10	1	0	$3\frac{3}{4}$	0	,,	,,	20th	1	2
June.....	13	17	38	3	1	$3\frac{1}{4}$	0	,,	,,	12th	5	,,
July	10	21	75	7	2	$5\frac{1}{2}$	0	,,	,,	1st	14	,,
August.....	8	23	46	6	1	6	0	,,	,,	9th	5	6
September	12	18	35	11	1	$2\frac{1}{4}$	0	,,	,,	22nd	4	,,
								,,	,,	23rd	4	,,
October	11	20	88	0	2	10	0	,,	,,	20th	13	6
November	17	13	39	6	1	$3\frac{3}{4}$	0	,,	,,	7th	4	,,
December	16	15	80	8	2	$7\frac{1}{4}$	0	,,	,,	22nd	9	,,
								,,	,,	23rd	9	,,
Total	141	224	663	6	21	8	0				101	2

nearly 7ft. $2\frac{3}{4}$ in each day.

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Woolhope Naturalists' Field Club.

First Meeting, Stoke Edith, May 23rd, 1876.

This Meeting was held jointly with the Dudley and Midland Geological and Scientific Society and Field Club. Present:—T. A. Chapman, M.D., President; Revs. J. Davis, R. H. Cobbold, H. B. D. Marshall, E. J. Owen, R. H. Williams, H. W. Tweed and Friend, R. Rees, Esq., Stephen Perrin, Esq., E. Davies, Esq., Mr. A. Thompson, Secretary.

The retiring Treasurer produced the statement of the accounts for 1875 duly audited, shewing a balance of £133 6s. 7d. in favour of the Club on December 31, 1875, and £13 of arrears paid up till March 13, 1876, the date of audit, which sums were handed over to the new Treasurer, leaving £34 1s. 6d. of arrears still due to the Club.

A letter from the Committee of the Hereford Free Library being read, it was proposed by the Rev. James Davies, and seconded by the Rev. R. H. Williams, that a sum of not less than £50 be given to the Museum Fund of the Hereford Free Library, subject to approval by the next meeting on June 27th.

Captain Doughty, Hampton Park, and Rev. John Goss, College, Hereford, proposed at Annual Meeting, were duly elected Members of the Club.

Captain Mayne Reid, Chasewood Lodge, Ross, was proposed and seconded for election at the next Meeting as an Annual Member.

They were afterwards joined by the following Members, &c., of the Club—Rev. R. P. Hill, Vice-President of the Malvern Club, and Honorary Member and Friend, Dr. Grindrod, Member of the Malvern Club, Rev. W. S. Stooke-Vaughan, and Dr. J. H. Wood, together with the following Members of the Dudley Club—C. Cochrane, Esq., President; Messrs. C. de Lessert, A. Freen, Fisher, A. Wyley, Bland, Dixon, Evers, Hartborne, Houghton, E. B. Marten (Honorary Secretary), Mathews, Pearce, Perry, Pugh, Rabone, Richards, Sheppard, Thwisfield, J. Underhill, H. Underhill, F. Underhill, and several ladies.

After visiting the gardens and house at Stoke Edith Park, by the kind permission of Lady Emily Foley, and inspecting the painted hall and some of the tapestries in the upper rooms, the party assembled on Seager Hill, when the general conformation of the Woolhope Valley was fully seen with central dome of May Hill sandstone and the double hills round, caused by the outcrop of the Woolhope and Aymestry limestones.

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A large party then visited the quarries, under the guidance of Mr. Arthur Thompson, Secretary to Woolhope Club, and gathered many fossils. A smaller party, under the guidance of Dr. Chapman, extended their walk to a greater distance, and within sight of the old landslip at The Wonder, and had a more complete view of this most interesting valley. All assembled at the Foley Arms Inn, Tarrington, to Dinner. After dinner, Dr. Wood read a paper on some peculiar Lepidoptera, but the Members of the Dudley Club had to leave before the paper was read.

ON THE CLEAR WING SPHINGES OCCURRING IN THE WOOLHOPE DISTRICT.—BY DR. J. H. WOOD.

Gentlemen,—Having been asked by our President to read a paper to the Club, I thought I could not do better than put together a few notes on a small group of Lepidopterous insects—very curious in themselves—which happen to be well represented in this neighbourhood, for out of the fourteen British species nine occur here. The scientific name of the insects is Sesia, but they are also commonly known as Clearwings. They are strange-looking moths, with their transparent wings and banded bodies, and look much more like wasps and ichneumons, and it is perhaps for this reason they are so seldom seen in the perfect state, being commonly mistaken for the latter insects. In one species at least, viz., Bembeciformis, this likeness is carried out even in the habits of the insect; for when settled on an object it keeps raising and depressing its body as wasps will do, and when it flies it distinctly buzzes. And to see, as I have done, one of these moths the size of a large wasp, with its yellow belted body, sitting on a wall in the sunshine, raising and depressing its abdomen, and presently taking wing, flying in a slow heavy manner and buzzing loudly all the while, you may well imagine there would be a moment's hesitation in handling so uncanny-looking a thing, even though you knew it were no better than a make-believe, like the donkey in the fable under the lion's skin. This case of Bembeciformis is an excellent instance of what is known as mimicry. Then again the larvæ of the Clearwings are all internal feeders living inside the roots and stems of different trees and plants, hidden away from the light, and they are for the most part very maggot-like in appearance—further points in which their resemblance to the Hymenoptera is borne out. It is no doubt in this stage of growth—I mean the larval—that the real origin and cause of the likeness is to be sought; but whether that cause depends on a similarity of surrounding circumstances, or on some anatomical ground, it is impossible to say. Yet as bearing on this question I should like to turn for a moment to the vegetable world, to point out how apparently the shape of a leaf will determine the growth and development of a plant. We all know the ivy; that it is a plant unable to support itself, that it has great

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freedom of linear growth and a peculiar and well-marked leaf. Well not uncommonly when we find this same shaped leaf occurring in another genus, the species so leaved forsaking the habit of growth usual in the genus assumes more or less that of the ivy. Look for instance at the ivy-leaved Campanula, the ivy-leaved Foodflax, the ivy-leaved Geranium. Here it would seem that the shape of the leaf or something in connection with that shape has induced the growth of all these very different plants more or less in the same direction. And we cannot but think that something similar is at the bottom of many cases of likeness in the animal world, and to be satisfied with the application of such a term as mimicry is unphilosophical, since at the best it can be but a preservative agent, and does not touch that deeper question, the origin and cause of the likeness.

But to turn to more practical questions. These internal feeders, at least those of them that infest trees, are necessarily injurious, but while some, as Bembeciformis, Apiformis, Tipuliformis and Sphegiformis, attack healthy and vigorous trees, others, as Myopiformis, Culiciformis, and Cynipiformis, prefer those that are diseased or injured. As has been said, the moths themselves are seldom seen, and are consequently scarce insects in collections. The only species I have noticed on the wing in the wild state have been Cynipiformis, Ichneumoniformis, and Sphegiformis, but when the habits of the larvæ are known, many of the species, even of those usually reckoned uncommon, may be obtained in abundance and without difficulty. All the smaller species have a tuft of bristles at the end of the body. This is an interesting anatomical feature, for in some specimens of Culiciformis that I bred I noticed they had the power of expanding it at pleasure. This tuft consists of three sets of bristles, a middle set which are horizontal, and a set each side which in repose are vertical and look downwards. It is in these side portions the movement resides, the insect being able to raise them and thus increase its horizontal superficies, an obvious advantage for purposes of flight and hovering. Probably all the species provided with this tail, so to speak, have the same control over it. I will now say a few words about each of the species that occur here.

Myopiformis is widely distributed but not abundant. The larva lives in the trunks of the apple trees, mining the bark. It seldom if ever occurs in sound parts, but attacks cankered or injured portions, selecting in these places the area that lies between the absolutely dead and the perfectly living bark.

Culiciformis is common here. The larva lives in the stumps of birch trees in woods the year after they have been cut down, feeding both under the bark and in the solid wood. It is also occasionally found in alder. Insects are capital judges of the natural relationship of plants. In the case of these two trees almost every larva that I know of that feeds on the one will also eat the other.

Formiciformis.—The larva of this species lives in osiers, and in company with those of the musk and other beetles does a great deal of injury. The books say it lives in the shoots; this is wrong, it is in the buts the larva feeds.

Icheumoniformis.—This is a good species. It occurs on one or two uncultivated sunny banks in this neighbourhood. Its life-history has only lately been

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made out. It lives in the roots of the birdsfoot trefoil (Lotus Corniculatus). I was led to find it here by noticing in the dry summer of 1871 the withered state of its food plant. The presence of a faded spray or two in an otherwise green mass of trefoil was a pretty sure indication that a larva was at work. Living some distance underground, the larva when full-fed spins a compact and strong silken tube up to the surface of the soil to enable the moth to emerge afterwards without difficulty. Those I had in confinement continued to construct this tube, though it was no longer necessary, since the roots they were feeding on were out of the ground.

Cynipiformis is another common species here, occurring both in woods and open country, but especially in the latter. The larva may be found in the bark of very old or injured oak trees, but it is difficult to get it out in these situations, and a far better place to look for it is in oak stumps the year after falling, that have been left in the ground. Sometimes quite a colony may be found in a single stump, and as the larva feeds just under the bark and does not enter the wood, a good strong knife turns them out very readily.

Tipuliformis, a common species in many places, but not so here. It feeds inside the young shoots of the black currant. To obtain it you are advised to cut the shoots indiscrimately, but this is a clumsy extravagant method and quite unnecessary. The larva when it is hatched generally enters the stem through a bud or in the region of a bud, and if in the early spring just before the buds open the eye is run up the previous year's shoots, the presence of a dead bud or a small black hole in its neighbourhood at once betrays the whereabouts of a larva.

Sphegiformis.—This is the best species that occurs here. It is completely a wood-frequenting insect, and affects the woods that are hilly and have a south aspect. The larva makes a straight burrow in the solid wood of alder saplings and occasionally in those of birch. The burrow is rather large for a moth of this size. The larva does not I think make any cocoon, but when full-fed scoops out a curved chamber at the top of the burrow close to the surface of the stem, leaving only the thinnest layer of cuticle at the head, through which the moth has afterwards no difficulty in breaking out.

Bembeciformis exceedingly abundant. Not a wood can be cut down but the burrows of its larvæ are to be seen in almost every sallow pole.

Apiformis is rather local but common in some spots. The larva lives in the trunk of the black and some other poplars close to the ground, and sometimes in the roots. Generally when this insect has taken possession of a tree it keeps to it year after year, till the lower part is riddled with the holes through which the moths have escaped. It is quite possible however for the entomologist to work away for some time in such a tree without finding the insect, at least I have done so before now till I found out the way to proceed. The grub appears to enter the tree below the surface of the soil, at any rate its burrow has a discharging opening below the surface, through which all the frass is ejected. By removing then the soil in the month of April, about which time the larva has spun up, the presence of fresh frass at once indicates a tenanted burrow, and by slitting it up the cocoon will be found; not uncommonly too, the cocoon occurs in the soil itself close against the

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trunk and not in the burrow. This is not the only species among those enumerated that enters the tree from beneath the soil. Bembeciformis and Sphegiformis both do the same thing. It might be thought that the object of this is concealment since there is no frass or visible opening to betray the presence of a larva, but I think the more probable reason is that the bark in this situation being thin and soft the little grub has less difficulty in entering here than elsewhere.

This brings my notes to an end, they are necessarily short and imperfect as time has not allowed me to go more fully into the subject. I have therefore drawn attention to those points chiefly which are not so generally known, and which may enable some other Lepidopterist, I wish there were more such in the country to fill up some blank spaces in his cabinet.

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Woolhope Naturalists' Field Club.

The second meeting of the season of the Club was held at Llanthony Abbey, on Tuesday, June 27th, 1876, on which occasion members were allowed to introduce ladies by special tickets. Present:—Dr. Chapman, President, in the Chair; Lord Bateman, Lord Lieut. of Hereford; Rev. W. S. Symonds, Honorary Member; Mr. L. Lyell; Miss Chapman; Mr. W. A. Swinburne, Vice-President; Mrs. and Miss Swinburne; Dr. Mc Cullough; Mrs. Rosher; Mrs. and Miss Steel and Mrs. Page; Mrs. Bradney, Miss Bradney and Mons. Wickel; Mr. Thomas Blashill; Mr. Cam; Rev. G. H. Clay and Rev. R. W. T. Hunt; Mr. and Mrs. James Davies and Miss Kent; Rev. W. C. and Mrs. Fowle; Mrs. F. W. and Miss Herbert; Rev. C. H. and Mrs. Bulmer; Mrs. Jones, Misses Jones and Eckley; Miss Headley, Captain Doughty, Major Harrison, Miss Jones, St. Cuthberts; Mr. and Mrs. H. S. Hall and Miss Pitt; Rev. H. W. Phillott, Rev. James and Miss Davies, Moor Court, and Miss F. Thomas; Mr. Armitage, Miss Armitage and Miss H. Armitage, Bath; Rev. G. M. and Mrs. Metcalfe, Dr. Bull, Miss Evelyn and Miss Marion Bull; Mr. Alfred Purchas, Mr. Arthur Thompson, Secretary, Mr. H. H. and Miss Wood; Mr. C. A. Key and Mr. C. M. Field; Rev. J. E. Grasett, Rev. C. J. Robinson, Mr. J. W. Lloyd, Mr. and Miss Stokes, Dr. and Mrs. Hincks and Miss F. Fairbanks; Rev. C. L. Eagles, Rev. J. M. Beavan, Rev. C. J. Westropp and Mr. Husbands.

Proposed by the Rev. James Davies and seconded by Mr. Cam, that the proposal made at the last meeting of granting a donation of £50 to the Free Library, at Hereford, towards the expenses of the Museum be confirmed.

Captain Mayne Reid, Chasewood Lodge, Ross, proposed and seconded at the last Field Meeting was duly elected an annual member.

Rev. Thomas Prosser Powell, Peterchurch Vicarage, Hereford, proposed by the Rev. G. M. Metcalfe, seconded by the Rev. H. B. D. Marshall.

Rev. C. E. Maddison Green, Lyonshall Vicarage, Kington, proposed by Rev. James Davies, seconded by Rev. W. C. Fowle for election at the next Field Meeting.

Proposed by Mr. Cam, and seconded by Rev. James Davies, and carried, that the President confer with Dr. Hogg and request him to attend the exhibition of Apples and Pears.

It was resolved to alter the day of holding the next Field Meeting which is to be a joint one with the Caradoc Field Club at Old Radnor and Stanner Rocks,

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om Thursday, July 20th, to Monday, July 17th, the former day having been fixed by Captain Rankin for his Bow Meeting at Bryngwyn, subject to the approval of the Caradoc Field Club which the Secretary undertook to obtain at their meeting the next day.

On the arrival of the party at Llanthony Abbey, some members, &c., that preferred it, ascended the Black Mountain and had a delightful view into Herefordshire, including Longtown Castle and Church Clodock Church and the surrounding district, whilst others proceeded up the valley to view the ancient yew trees in the churchyard at Capel-y-finn, &c.

On the return of the party to the Abbey about 3·30, they partook of luncheon.

After luncheon Dr. Mc Cullough delivered an address on the Geology of the district, which was illustrated by fossils.

Mr. Blashill (London) immediately after gave a very interesting description of the Abbey, which unfortunately had to be curtailed by the Secretary announcing that the time had arrived for their departure to Llanvihangel in time for the last train to Hereford.

LLANTHONY PRIORY.

At the close of the proceedings Mr. Blashill conducted the party over the ruins of the conventual buildings, giving a short description of their chief features. The Priory was founded early in the 12th century by one William, a retainer of Hugh de Lacy, who, while hunting found himself in this secluded spot where was a little chapel, said to have been built by St. David. He was joined in his undertaking by Ernesi, chaplain to Maud, the Queen of Henry I., and, having been himself afterwards ordained, it was but natural that these two priests should make it a house of Canons regular of St. Augustine, an order consisting of clergy only, rather than a house of Monks. The great Cistercian order, whose houses may be said to monopolise such lonely sites as this, was not introduced into England till 1128 (its third house, Tintern, was founded in 1131), and whatever might have been the success of this order had it been here established, it is certain that the Augustinian Canons failed, as they might have been expected to fail, to secure property in this spot. Their first church was dedicated in 1108, but the buildings now remaining belong to the latter half of that century; for although most writers upon the history of this building have been led to attribute it to the earlier date, it is quite clear from the style of its architecture, which is transitional between the Norman and Early English periods, that this is not the original structure. The Canons who formed its first inhabitants were brought from the first Augustinian house in England, that of St. John the Baptist at Colchester, and this establishment received the same dedication. This community suffered greatly from the inhospitable character of the site and from the attacks of the Welsh. They afterwards received a grant of land at Gloucester, where they built another monastery,

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known as Llanthony the second, to which this house became subordinate, and so was indifferently maintained down to the time of its dissolution in the reign of Henry VIII. Such parts as remain habitable are now used as an inn, the fabric generally being fairly kept up by its present owners, the family of the late Walter Savage Landor.

The church consists of nave with north and south aisles, between which are arcades of seven arches, which like all the larger arches of the building are pointed, while the smaller arches are semicircular, a characteristic of buildings of its date. The south arcade fell within living memory, the outer walls of both aisles had probably been destroyed long previously. The piers of the arcades are square, with angle-shafts carried quite round the arches without any capitals. The chancel is a very fine long structure without aisles, lighted by tall narrow windows, its ornament consisting mainly of plain scolloped capitals of late Norman work. The north transept has disappeared, that on the south side remains, and had a fine chapel of 13th century character to the east of it, to which a wide semicircular arch that appears to have originally consisted of two pointed arches gives access. The central tower is a ruin, though its western and southern arches still support massive walls, with small 12th century windows. Three stages of a fine pair of western towers remain, the rooms in them being used for the purposes of the inn. A fine triplet of pointed windows existed between them, as we know from old engravings; but these have disappeared, and the whole face of the lower part of the west front has been repaired and altered—no doubt with the best intentions—perhaps half a century ago. The present kitchen formed originally a very handsome entrance from the precinct into the cloister. It is vaulted, and has the remains of a good doorway on the west side. Some other buildings, which formed cellarage, and probably the rooms for lay brethren and guests, adjoin this entrance, having extended originally along the west side of the cloister as far as the ivory kitchen, that would then stand at the west end of the refectory. The cloister, which had a wooden roof, has disappeared. On its east side adjoining the south transept is a beautiful example of those remarkable apartments, which are nearly always found in that position, and which have been called sacristy, treasury, library, exchange, mortuary, penitentiary, &c., no one name seeming to fit satisfactorily the different kinds of room which exist in different monasteries. Here it is entered by a beautiful 13th century archway, which had no doorway. It is vaulted in stone, and has an eastern window. It contains both the scolloped capitals of the 12th century and those of the finest style of 13th century foliage, showing that the canons having built their church next proceeded with the subsidiary buildings. Adjoining this apartment (now a gig-house) are the remains of the chapter house, which was apsidal, and beyond it to the south were the day-room and dormitory of the community, which have been considerably altered, and are now in ruins. The refectory extends along the south side of the cloister garth—its vaulted substructure can be traced with some remains of the upper portion.

Southward of the conventual buildings is that which is now the parish

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church, and what some writers have thought to be the original chapel built by St. David! while others think it to be the first church of the Priory built by William and Ernesi. Here Mr. Blashill pointed out that there had at one time been gates or folding doors, which shut off the chancel from the nave—the iron hinges of which could still be traced—his opinion being (as he had stated when the British Archæological Association visited Llanthony in 1870) that the building was the infirmary of the priory, which by a few obvious alterations had been adapted for a parish church.

Some of the company visited during the day the gate-house, which stands to the west of the church, and is a very fine specimen of pointed architecture, erected after the completion of the monastic buildings.

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Woolhope Naturalists' Field Club.

The third meeting of the above Club was held at Old Radnor and Stanner Rocks on Monday, July 17th, instead of Thursday, the 20th, to meet the Caradoc Field Club, Present: Mr. W. A. Swinburne (Vice-President), Rev. W. L. Bevan, Mr. R. W. Banks, Mr. Joseph Carless, Rev. J. H. Crouch, Captain Doughty, Major Bush, Rev. W. D. V. Duncombe, Rev. J. E. Grasett, Mr. J. Bowler Evans, Mr. John Lambe, Rev. G. H. Clay, Rev. H. B. D. Marshall, Mr. T. Clifton Paris, Mr. E. Piper, Mr. O. Shellard, Rev. S. Thackwell, Rev. H. W. Tweed, Rev. W. Wyatt, Mr. J. W. Lloyd, Mr. Lloyd, Mr. Arthur Thompson (Secretary).

Members of the Caradoc Field Club.—Present: Rev. William Elliott (secretary), Rev. J. Owen Rocke, Rev. C. Warner, Rev. J. Lambert, Mr. Wm. Langstone, Rev. H. Day, Rev. H. Brown, Mr. F. R. Smith.

On the Stanner Rocks Mr. R. W. Banks delivered an address on the geology of the district, and for which an unanimous vote of thanks was given to him.

On the return of the party to Kington, at 5 o'clock, they partook of dinner at the Oxford Arms Hotel.

Resolved—That the next meeting, to be held at the Brown Clee Hill on the 18th August, be adjourned to 25th August, to enable the Secretary to be present, he having announced that he should of necessity be absent from home on the day first fixed.

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Woolhope Naturalists' Field Club.

The Fourth Field Meeting was held at Brown Clee on Friday, 25th August, having been postponed from Friday, 18th (see resolution passed at the last meeting on 17th July). Present: Dr. Chapman (President), James Rankin, Esq., Rev. A. E. Hornby, G. H. Lin, Esq., Capt. Doughty, Major Bush, Mr. Horne, Mr. O. Shellard, Rev. G. H. Clay, Mr. Cocking, Mr. J. T. Owen Fowler, Mr. Jos. Graves, Rev. Philip Norris, Mr. T. C. Paris, Mr. G. H. Piper, Mr. A. Purchas, Rev. Stephen Thackwell, Mr. Rogers, Mr. Arthur Thompson, Miss Hodgson, Rev. Albert Clowes, Rev. John Sempson, Mr. E. Y. Steele, and Mr. John Kent.

On the arrival of the party at Ludlow they proceeded in carriages to Clee St. Margaret's, where they were met by Rev. Albert Clowes, who conducted them to his church, and from thence to the Roman Camp of Nordy Bank (on which he read a short paper), and the British remains on Abdon Burf; afterwards passed over the Brown Clee and down through the Burwarton pleasure grounds, by the kind permission of Viscount Boyne, to the village of Burwarton, where the old and new churches were visited.

They afterward dined at the Boyne Arms Inn. After dinner Mr. Rankin read a paper on the "Formation of Soils."

NORDY BANK ON THE BROWN CLEE.

The following remarks I have collected from a paper written in 1873, for the Severn Valley Naturalists' Field Club, by a friend of mine, the Rev. Augustus Thursby-Pelham, a son of the lord of this manor.

Nordy Bank still stands bare, as when the Roman camp was formed here more than 1,800 years ago. It has not been destroyed by the plough, nor has it been hidden by timber like Norton Camp, which had even a more commanding position above the present Craven Arms. And as the sheep now grazing here symbolise peace, so was this Roman camp formed for the furtherance of peace rather than of war. Nordy Bank was most probably one of the camps which Ostorius Scapula, the Roman Proprotor in Britain (A.D. 50), established between the Avon and the Severn. Certain British tribes, under Caractacus or Caradoc, were at that time in this part of the country in open revolt against the Romans. After their defeat they gave much trouble to their conquerors, while living among their native woods and marshes. It was under these circumstances that the Roman General formed stationary camps in commanding positions, such as this is. This particular camp was of such importance that it was connected with Uriconium by a paved military road, part of which is still in existence under the

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name of the Devil's Causeway, and which has left traces in other parts by the names Tugford, Hungerford, Roman Bank, &c. Nordy Bank then was a chief permanent camp intended to keep the peace among the conquered.

The shape is a rounded parallelogram, from east to west 210 paces, from north to south 144.

After a time a peaceful and prosperous population sprang up around. Thus the origin of the village just below, still often called The Clee*, watered by an unfailing brook, sheltered by the hills, and protected by this encampment. After the departure of the Romans from Britain the village remained; and when the Templars brought the legend of Saint Margaret from the east, the then Lord of Holgate founded the church there under the name of that saint.

ALBERT CLOWES, Vicar of Clee S. Margaret.

ON THE FORMATION OF SOILS.—BY JAMES RANKIN, Esq.

At the outset of this inquiry it will be necessary for us to remember that our earth, in the beginning, was formed of a variety of substances which we call elements, and which elements are capable of entering into a countless variety of combinations to give rise to the different forms we find on the earth, and that under the influence of various agents, whose action has been unceasingly in force for innumerable ages, the earth has assumed its present configuration,—that is to say, it is now as we find it composed of hills and valleys, lakes and rivers and seas, and the land is, for the most part, covered with some description of vegetation.

It will be well now to consider what those agents are and what is their manner of action.

The chief agents connected with the formation of soils are the *air*, *wind*, and *rain*, *frost*, *snow*, and *water*. These six are the most important in the formation of soils; although not all *chemically* distinct, yet their *physical action* is so, and therefore I prefer to speak of them as different forces.

The action of these forces is so constant and at the same time so apparently trifling that many are apt to think that they can have but little influence in changing the external form of the globe; that such, however, is not the case becomes evident to those who are in the habit of closely observing the mysterious workings of the forces which pervade our universe.

The air of our atmosphere is composed of oxygen, nitrogen, and carbonic acid gases. Oxygen gas enters into combination with a great many of the common constituents of the earth, such as iron, aluminium, sodium, sulphur, and others, and forms with them substances known to chemists as oxides. It is this process of oxidation which has such an effect in wearing away and loosening the outer surface of rocks, and in this condition the loosened material is washed down by rains and goes to fill up some deposit elsewhere, while a new and clean surface of

* Clee is the Latin clivus, a hill, so that the usual expression 'Clee Hill' is really tautology.

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rock is presented to the action of the air. Here we have one cause of the change of the form of the earth's surface. The above may be said to be the chief action of the air.

We will now look at the next agent—wind. The wind, as everybody knows, is only the air in motion, but the effects and action of wind are sufficiently recognisable to strike the mind of most people and to convince them that the wind is a very important agent. Its effects as a soil-forming agent are best seen in hot dry countries, such as North Africa, where the soil is very friable, parched, and light: in such countries the wind carries the sand and dust along with it for miles, and often deposits it far away from its parent rock. Although in our island we do not see the effects of wind on the soil on such a large scale, yet any one who has ever visited a sandy sea shore must have witnessed considerable hillocks or sand-dunes, as they are called, formed by blown sand. The oxidising power of the air is of course in action in the wind as well as in still air, so that the wind has a double action, both chemical and physical. Lastly, I will only just mention the power of the wind to waft seeds and other vegetable matter to all parts of the earth, where, if the circumstances are suitable for them, they take root and grow up, and thereby bind together the loose particles of the soil by their roots. This may be called an indirect effect of the wind in the formation of soils.

I must now pass on to *rain*. Rain washes down all loose and friable matter, and carries it on till it deposits it at the bottom of some valley or river-bed; it also finds its way through the interstices of rocks, and by its chemical action as well as its physical, takes up in solution some of the substance of the rock through which it passes; this kind of action I will speak of when treating of the effects of water.

Snow like rain washes down loose materials, but it is large masses of accumulated snow such as are seen in Switzerland and elsewhere that have such a powerful effect in breaking off huge masses of rock and bearing them away to be disintegrated by the air and other forces.

Compact frozen snow, in the form of glaciers, wear away, and erode the valleys through which they pass, and carry away with them an immense amount of materials which are deposited when the snow and ice melt and form a "terminal moraine."

Frost is another important agent. Frost is the name applied to that state of atmosphere which is below 32 [degrees on Fah. thermometer, or below zero on the centigrade; its most obvious effect is that water congeals and becomes ice: this is a most important effect as water when it becomes ice increases in bulk, and of course becomes specifically lighter; so that when water which has run into crevices of rocks freezes, it expands and cracks the rock and frequently breaks off large masses, just as gun-powder would do; these masses of rock either roll down the hill side and at the bottom gradually decay and form soil, or they are borne away on the crest of a glacier or ice berg far from their parent rock. This affords an explanation of the frequent phenomena of boulder-stones, which are stones

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found in a great variety of places far away from the rock from which they were once a portion.

I now come to the consideration of the last though not the least of the soil forming agents, viz., *water*. I use the term water here, in distinction to rain, although chemically the same, and apply it only where water occurs in some quantity, as in the case of streams, rivers, lakes, and seas.

Water has two important methods of action, one a physical or mechanical, and the other a chemical one. I propose to consider each of these methods separately.

By the first, or mechanical action, water abrades and wears away the surface of any rock with which it comes in contact, and then according to the state of motion or of quiescence of the water, the abraded particles are either carried out far from their parent rock or allowed quietly to sink to the bottom at the foot of the rock from which they were taken.

A brief consideration of the abrading and transporting power of water will I think explain to us the three following phenomena so often seen in connection with soils.

1st, why sometimes the soil is of the *same* nature and composition as the rocks in the immediate neighbourhood and sometimes of a totally *different* nature.

2nd, why beds of one sort of material, such as gravel lie intermingled with beds of another sort of material such as clay, &c.

3rd, why the same bed or stratum of soil is frequently found to be composed of a mixture of materials, such as sand and clay.

With regard to the 1st of these cases, I think it is not difficult to understand, how slow, shallow streams, and the waves of lakes and seas, where no currents exist will not carry off their sediment to any great distance from the rock from which it was abraded, but will allow it to sink quietly to the bottom there to form a soil of the same nature as the rocks in the neighbourhood, and on the other hand, that rapid streams and currents, such as occur in mountainous districts do carry away their sediment to great distances, often hundreds of miles from the rocks from which it was abraded, and deposit it somewhere to form a soil often totally unlike in composition to the rocks in the vicinity.

This transporting power of water which though familiar to everybody, and is seen in every ditch and puddle, is not perhaps seen in this country to the same extent as in some others where the mountains are higher, and therefore in order to give you a clear idea of what an important force it is in soil formation, I will adduce one case, namely that of the Ganges.

Delta of Ganges. The river Ganges is one of the largest rivers of India, it forms the main drain of the North-Eastern portion of India, and pours its waters into the Bay of Bengal. Throughout its whole course it receives large contributions from tributary streams coming down from the lofty Himalayas, and

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before reaching the sea is joined by the river Brahmapootra, a river as large as the Ganges itself. Many miles however before reaching the sea these great rivers are split up into several branches, on one of which the Hoogly, stands the important town of Calcutta.

It is not an easy matter to fix the point where the delta begins; it is however stated that the delta of the Ganges begins about 216 miles in a direct line from the sea, and the delta of the Brahmapootra 224 miles from the sea; these deltas it must always be remembered have long ago coalesced to form but one, which has a great number of mouths; we may say then that the combined delta of Ganges and Brahmapootra begins about 220 miles from the sea, that is a distance equal to that from Hereford to Newcastle-on-Tyne, and nearly equal to that from Aberystwith on the Welsh coast to Lowestoft on the East coast. The breadth of the delta is about 200 miles, and as it is as wide 220 miles from the sea as it is at the coast, the area of the delta will be about 4,400 square miles.

The amount of sedimentary matter in the united waters of the Ganges and Brahmapootra has been estimated at $\frac{1}{856}$ part of the water in bulk during the four months of rains, when the discharge of water is estimated at 494,208 cubic feet per second, and this gives 577 cubic feet of mud discharged in a second. The rains last about four months, or 122 days, and therefore the total discharge of mud during the rains is, 6,082,041,600 cubic feet. The quantity of mud discharged during the eight [dry months is estimated at 286,035,840 cubic feet, so that the whole annual] discharge is 6,368,077, 440 cubic feet. This amount of mud would raise a surface of 228½ square miles one foot. When we consider for what countless ages this action has been going on we cease to wonder at the effects produced, and we recognise the importance of running water as a soil forming agent.

I might here remind you that the sediment brought down by the Ganges, comes chiefly from the Himalayas upwards of a 1,000 miles distant.

This one case out of many must suffice to show us the great power of water, for it is only the principle that we are engaged with at present, and we cannot delay over many examples. I may say, however, that anyone who likes to take the trouble to study the subject of deltas and alluvial formations for himself will be amply repaid.

I must now pass on to the second case and explain how beds of different materials lie interstratified with one another. The power of running water to carry matter along with it depends upon its velocity, and when its velocity is increased then its power of transportation is increased also.

The law of the transporting power of running water may be thus stated:— "The power of water to move bodies that are in it, increases as the sixth power of the velocity of the current." (See Jukes's Geology).

Thus if we double the velocity of a current its motor power is increased 64 times $(2^6)=64$; or, in other words, if a stream moving at a velocity $= A$ was increased to a velocity $= 2A$, and if at rate A it could move a body of 1 lb. weight,

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then at rate 2A it could move a body of 64 lbs. weight. If again its velocity be trebled its motor power is increased 729 times.

Again, it has been observed that water moving at the rate of

3	Inches	in a	sec.	tears up Fine Clay.
6	,,	,,	,,	Fine Sand.
12	,,	,,	,,	Fine Gravel.
36	,,	,,	,,	Large Gravel.

Carrying the above laws in our mind it is apparent that if any alteration in the velocity of a stream takes place the positions where the several bodies, viz., gravel large and small, sand and clay, were deposited will be materially altered, and very probably if the velocity is increased large gravel will be borne away and deposited where formerly only fine clay reached, and if velocity be diminished the fine clay might be deposited where formerly the gravel was.

Thus we see by the motor power of water the superposition of beds of materials of different densities can be accounted for; how, for instance, a bed of large gravel may be found above a bed of fine clay. In still water, of course, the heavier materials will always form the lowest beds.

With reference to the third case, it is easy to understand how streams passing through and over rocks of a varied composition will carry away detritus of a mixed composition, and if the materials be of the same density they will be deposited somewhere or other in the same bed, and form a mixed soil. Soils of this description are much the most common and I may add much the most desirable.

With regard to this most interesting subject, viz., the power and effects of water in modifying this earth's surface, I must refer you to some of the standard works on Geology, such as Sir C. Lyells, and others, where you will find abundant examples of cases of which I have spoken above, besides other interesting matter. But it is impossible for me in a short paper to dwell longer on this part of our subject, I will therefore now pass on to the second mode of action of water, namely the Chemical action.

Water has the power of holding in solution various substances, such as mineral salts, as Bicarbonate of Lime, Hydrated Lime, Chloride of Sodium—common salt, Chloride of Magnesium, and many others. These substances, derived chiefly from the decay of volcanic rocks, are taken up by water and carried away to be mingled with other soils. On evaporation of the water, these substances are left in the soil and again rendered soluble by rain, and in that state taken up and assimilated by plants. This power of water is of the highest importance with reference to the fertility of soils, for no soil is fruitful without the presence of some at least of these mineral salts.

Many *hard* rocks, as well as soft soils, owe their origin to this chemical power of water; the most notable of these stony deposits are the Travertins of Italy and elsewhere. This Travertin is a rock generally of whitish grey or yellow color, very hard, and composed entirely of Carbonate of Lime, pure limestone,

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Although largely developed in Italy, where nearly all the churches are built of it, it is also found everywhere, where limestone rocks exist, more or less.

With this brief survey of the process of soil-formation by the mineral or inorganic kingdom, we must be content and now take a glance at the share taken by the organic kingdom.

We must suppose a soil of mineral constituents, capable of supporting plant life, to have been formed, and to have become dry land. On this, ere long, the seeds of plants wafted by the wind, or dropped by birds, will find a resting place, take root, flourish and decay, and leave their substance to be again returned to the soil; but they will also shed abroad their seeds and in time the whole surface of the ground will be covered with some sort of vegetation; on this vegetation animals will come and feed, and leave their fæces, and when they die their carcasses to enrich the soil, the bones of animals being a valuable manure. This process going on for a long continuance of time will give rise to the humus or vegetable mould found in all agricultural soils. This humus is always much increased by tillage and manuring, and is always most plentiful in soils which have been long under cultivation.

If again from any geological cause the soil is depressed below the water, or has not yet risen above the water, as swamps and bogs, the vegetation, if any exist, which will always be of an aquatic kind, when it dies down, will be preserved by the water from decay for a very long period, and by accumulations of vegetable matter of this description peaty soils are formed.

These formations are well seen in the North of Ireland and South of Scotland. I may mention here that this peaty soil is the commencement of the formation of coal; the vegetable or organic matter is gradually replaced by mineral.

Mr. Rankin promised at a future meeting to read as a sequel to this paper, another on the composition and character of the different varieties of soils.

NOTE ON CHILOCORUS RENIPUSTULATUS,

By T. A. Chapman, M.D.

These notes are a very poor apology for a complete history of the beetle they refer to, but I submit them to the club as not being devoid of interest, whilst it is doubtful whether I shall ever be able to render them more complete.

The subject of these notes is a small beetle of the family Coccinellidæ (the Lady-bird.) It must take rank among useful insects, as indeed all the Coccinellidæ do. It preys upon an enemy of the ash as grown for hop-poles, and is thus a friend to the hop grower. The hop itself has at least three species of Lady-birds that prey upon the aphides which so frequently infest it, so that no

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plant is probably so much indebted to this family of beetles. They are no doubt in consequence held in high respect by all drinkers of beer. The beetle is accounted rather a scarce one and is no doubt rare except in a hop-growing district.

I owe my first introduction to the insect to Dr. Bull. On a fungus foray early in the season in which the prizes were to be found among the smaller forms, he espied a valuable spheria covering the bark of an ash sapling. After briefly reconnoitring it with a pocket lens he called me to the front and handed the supposed spheria over to me as belonging to the insect world, Dr. J. G. Morris who was of the party agreed to the session and added an opinion that the insect was a scale insect, an opinion that proved to be perfectly correct. Shortly afterwards some small spinous larvæ were detected amongst the scale insects, and proved to be those of *Chilocorus Renipustulatus*. This was early in July. The scale insects then were chiefly represented by the egg masses covered by the body of the female insect of the previous year though numerous newly hatched larva also were present. The usual season for hatching is probably in June. I have not the name of this species, but it belongs probably to the genus Aspidiotus, along with the so-called American blight of the apple; the scale of a similar species may often be observed on oranges. This Aspidiotus of the ash bark is a very minute species as compared with the A. Conchiformis (American blight) of the apple. What it lacks in size it makes up in numbers for the bark is so closely packed with them that they overlap each other. The habitat is the bark of the ash where thickly grown usually from old stools for hop-poles. The bark of these is green with the sap immediately beneath the surface, within easy reach of the short beaks of the *Aspidiotus*, quite unlike the hard solid bark of an old tree. The sap they extract must necessarily materially injure the plants, though I could not detect by the eye any difference in vigour between affected trees and others. It also occurs more sparingly on the alder, *Alnus glutinosa*.

Like the apple blight, the larva of Aspidiotus have a woolly excrescence, and are usually packed so closely as to give the bark the appearance of being covered by a greyish mould. In the autumn (August and September) they reach maturity. The females are apterous and scale like, the males are very minute delicate insects of a yellowish colour with two wings, almost veinless; the second pair being either very minute or wanting.

The beetle, *Chilocorus Renipustulatus* passes the winter in the perfect state, and in April or May lays her eggs in small groups, when she finds the aspidiotus to be abundant. On these the larva feeds, so far as I know eating the bark-louse in whatever stage of existence it happens to be. If food is sufficiently abundant the larvæ keep tolerably well together and may almost be called gregarious, especially collecting closely together when about to undergo their several moultings; if their prey be scarce they scatter themselves more widely. Sometimes one sapling has hundreds of larva on its stem—a dozen or two is the more usual quantity. I do not know how often the larva moults, certainly three times, probably four. When full grown, it attaches itself to the bark by the anal segment, head downward, and assumes the pupa state; like some other of the same family the larva skin is not

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fully cast off, but splitting open down the back, remains like a great coat enveloping the rest of the pupa; the portion of the pupa that is visible is black and shining. The pupa state exists for only a few days in hot weather for over a fortnight if the weather be cold. In August and September the beetles appear; they themselves feed on the aspidiotus, and at the first sign of winter seek for a secure hiding place until the spring.

The specimens which I present will give a better idea of this insect than any description. All the Coccinellidæ have a strong family likeness, this genus *Chilocorus* differs in facies from Coccinella, by the more truncate front, due to a more arched form of thorax. The larva as you may gather from its cast skins is spinous, its breadth is about that of the beetle but it is longer, tapering somewhat to either end. The spines are long and composed very similiar to those in the larva of Vanessa. They are ranged in three rows on either side, subdorsal, supra-spiracular, and lateral, one on each segment, excepting on the first thoracic segment, which has two subdorsal and two lateral spines, the second thoracic two lateral spines, thus affording one of those instances which have been supposed to indicate that these segments are really formed by a coalescence of two ordinary segments. The lateral spine is reduced to a mere tubercle in the 12th segment, and the 13th segment has only four tubercles. The colour of the larva is a dull brownish black passing into brown in the incisions of the segments and beneath. It has six legs and an anal proleg like other larvæ of the same family.

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1. RUSSULA LUTEA. 2. AGARICUS SAPINEUS. FR.

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HEREFORDSHIRE FUNGUSES.

RUSSULA LUTÆA, Fr.

YELLOW RUSSULA.

This delicate species has a wide range of growth, and is usually to be found on the short turf of high woodlands, or tree-shaded commons.

Description.—Plant, fragile, mild in taste. Pileus, 1-2 in. broad, rather firm, plano-depressed, with a viscid yellow cuticle becoming pale, rarely white, margin even. Stem, white, soft, slender, more or less hollow. Gills, free, crowded, connected by veins, and of an egg yellow colour. Flesh, white. Spores, yellow, echinulate, diameter .000,32 in. *Fries' Epicrisis, p. 451. Engl. fl., V., p. 21. 'Hand-book of British Fungi," I., 226. Cooke's "Grevillea," Vol. VI., pl. 91.*

Not unfrequent in Herefordshire; Dinedor Common; Haywood Forest; Whitfield; Downton, &c.

AGARICUS (FLAMMULA) SAPINEUS, Fr.

BRIGHT SPORED FLAMMULA.

This very fine species is remarkable for the bright colour of its spores. It usually grows in clusters on fallen branches of fir, or chips of wood, and most commonly on charcoal heaps in the woods. It is very variable in size, and especially as to the breadth and mode of attachment of the gills.

Description.—Pileus, 1-4in. broad, compact, convexo-plane, very obtuse, finely flocculoso-squamulose, then cracked, disk of a golden yellow colour, subopaque, with the margin more pale and shining. Stem, usually short and thick, solid, stuffed, or hollow, often compressed and lacunose, rooting, without a ring, of a yellow colour, with vestiges of the yellow veil scarcely manifest. Gills, adnate, broad, of a golden yellow and then tawny cinnamon. Odour, strong. Spores, ·00032 × 0002 in. *Sys. Myc. I., p. 239. Engl. fl., V., p. 95. B. & Br. Ann., N. H. 1865, No. 1006. Pers. ic. et Descr., t. 4. f. 7. Handbook of British Fungi, Vol. I., p. 124. Cooke's Grevillea, Vol. VI., pl. 91.*

This species was brought to the Fungus Exhibition of the Woolhope Club in 1867, by the Rev. Wm. Houghton, M.A., from the charcoal heaps of the Wrekin. It was then very rare as a British plant, but it has since become more common. The drawing was made from a specimen sent by Mr. Renny, from Chatsworth, in Derbyshire.

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Woolhope Naturalists' Field Club.

The usual meeting of the members of the above club, together with their scientific visitors, was held on Thursday, September the 28th, at the Free Library, Hereford, for a fungus foray to the grounds of the Rev. Archer Clive, Whitfield. In consequence of its being a thoroughly wet day, the proposed fungus foray had to be abandoned. Amongst the members and visitors present during the day were —Dr. Chapman (president), Rev. William Jones Thomas, W. A. Swinburne, Esq. (vice-presidents), Rev. M. J. Berkeley, Dr. Hogg, Professor T. W. Thistleton Dyer, Rev. Wm. Houghton, Major Houghton, Mr. Houghton, Thomas Howse, Esq., M. C. Cooke, Esq., Edwin Lees, Esq., William Phillips, Esq., Shrewsbury; C. B. Plowright, Esq., James Renny, Esq., Worthington G. Smith, Esq., Arthur Smith, Esq., Dr. Vachell, Cardiff; Rev. J. E. Vize, T. Walker, Esq., Tunbridge Wells; Mr. Walker, Mr. Walker, jun., Dr. Bull, Thomas Cam, Esq., Orlando Shellard, Esq., (Mayor of Hereford), Rev. James Davies, Rev. C. H. Bulmer, Rev. Edward Cunningham, Captain Doughty, Rev. E. G. Doughty, Major Bush, Rev. W. D. V. Duncumbe, Mr. Forty, J. T. Owen Fowler, Esq., F. W. Herbert, Esq., Rev. J. E. Jones-Machen, H. C. Moore, Esq., J. Griffith Morris, Esq., Dr. M'Cullough, Elmes J. Steele, Esq., J. C. Kent, Esq., J. F. Symonds, Esq., C., Watkins, Esq., Mr. Chapman, and Mr. Arthur Thompson, secretary.

The following officers were appointed for the year 1877 :—They will not take office until after the general meeting, to be held in the early part of next year.

President : J. Griffith Morris, Esq., Hereford.

Vice-Presidents.—T. Algernon Chapman, Esq., M.D., Burghill, Hereford; Rev. James Davies, Moor Court, Kington; D. M. M'Cullough, Esq., M.D., Larchfield, Abergavenny; Elmes Y. Steele, Esq., Abergavenny.

Central Committee of Management : Timothy Curley, Esq., Broomy-hill, Hereford; C. G. Martin, Esq., Broad Street, Hereford; Orlando Shellard, Esq., Barton Manor House, Hereford.

Editorial Committee : T. Algernon Chapman, Esq., M.D., Burghill, Hereford; Rev. Sir G. H. Cornewall, Bart., Moccas Court, Hereford; Rev. C. J. Robinson, Norton Canon, Weobley; Rev. J. Davies, Moor Court; Rev. H. Cooper Key, Stretton Rectory, Hereford; James Rankin, Esq., Bryngwyn, Hereford; D. M. M'Cullough, Esq., M.D., Larchfield, Abergavenny; Rev. H. W. Phillott, Staunton-on-Wye, Hereford.

Treasurer :—Thomas Cam, Esq., Hereford.

Secretary :—Mr. Arthur Thompson, 12, St. Nicholas Street, Hereford.

Auditors :—James Davies, Esq., and J. T. Owen Fowler, Esq.,

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M. C. Cooke, Esq., 2, Grosvenor Villas, Junction Road, Upper Holloway, London, N.; Rev. J. E. Vize, Forden Vicarage, near Welshpool, together with the President and Secretary of the Cardiff Naturalists Field Club, were unanimously elected honorary members.

At the close of the above business, a paper was read by M. C. Cooke, Esq., on "The Structure and Functions of Paraphyses."

After dinner at the Green Dragon Hotel, the President briefly proposed "The health of the Queen," and then called upon Dr. Bull to give a "Sketch of mycology in Herefordshire," who concluded by proposing the health of the honorary members and visitors, coupling with it the names of Rev. M. J. Berkeley, Dr. Hogg, and Professor T. W. Thistleton Dyer, to which they all three replied.

After this a paper was read on "Fungological Difficulties," by the Rev. J. E. Vize. The majority of the members, &c., then adjourned by the kind invitation of Thomas Cam, Esq., to a soirée at his house, when additional papers were read by C. B. Plowright, Esq., on "Fungi"; Wm. Phillips, Esq., on "Three rare Herefordshire Pezizas"; Worthington G. Smith, Esq., on "The Reproductive Process in Boletus Subtomentosus; and Worthington G. Smith, Esq., on "A New Species of Urocystis on Gladiolus Corms."

The exhibition of apples and pears was on a much larger scale than last year, although the season was considered unfavourable. It consisted of 637 lots, besides the usual display of *funguses*, which was not quite so numerous in the rarer forms as usual, but included some very fine specimens.

A FUNGUS FORAY AT SHOBDON COURT, LEOMINSTER.

During the past week many gentlemen distinguished in Mycological Science have been visiting our city to join in the "Fungus Forays" of the Woolhope Club, which have now become so widely celebrated. On Friday, the 29th ult., on the invitation of the Lord-Lieutenant of Herefordshire, the "Foray" was fixed for Shobdon Court. The following gentlemen and ladies left by the 9.20 a.m. train for Kingsland:—Dr. Chapman (the President of the Woolhope Club), the Rev. M. J. Berkeley and Miss Berkeley, Dr. M. C. Cooke, James Renny, Esq., Worthington G. Smith, Esq., Arthur Smith, Esq., and Thomas Howse, Esq. (from London), the Rev. Wm. Houghton (Preston Rectory, Salop), Wm. Phillips, Esq. (Shrewsbury), Rev. John E. Vize (Forden, Welshpool), Edwin Lees, Esq. (Worcester), J. C. Kent, Esq. (Earl's Croome), C. B. Plowright, Esq. (King's Lynn), Dr. McCullough and Elmes Y. Steele, Esq. (Abergavenny), Edward Houghton. Esq., and Arthur Houghton, Esq. (Bath), Rev. James Davies and Miss Alice Davies (Moor Court), T. Walker, Esq. (Tonbridge Wells), Rev. E. Cunningham (Marnham, Newark); with the following ladies and gentlemen from Hereford: Dr. Bull, Mrs. Read. and Miss Bull; J. F. Symonds, Esq., and Miss Edith Symonds; Thomas Cam, Esq., J. Griffith Morris, Esq., and J. T. Owen Fowler, Esq. Lord Bateman kindly sent his omnibus to Kingsland, and by

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this and other carriages the party were quickly conveyed across "the great west plain," as it was formerly called, to Shobdon Court. The battle of Mortimer's Cross was the last battle fought on Herefordshire soil, and beyond question the most important. It revived the fallen fortunes of the Yorkists when at their lowest ebb, and placed the young victor, Edward IV., on the throne. The details of the battle were pointed out in passing across the field, and excited great interest, but this must not now be dwelt upon.

A most cordial reception by Lord and Lady Bateman awaited the visitors at Shobdon Court. The grounds of the mansion were first visited, and the scenery presented in all directions fully admired. The grouping of the trees and their great variety, show the ability and taste which have been displayed here in the art of landscape gardening. Many individual trees were especially fine. Time failed to measure the girth of the magnificent oaks and splendid sweet chestnut trees on the approach to the mansion; but on the lawns in front it was impossible to pass by some cedars of Lebanon of truly remarkable size,—one trunk broken short off by some dire calamity, at about 25 feet high, but with a yet perfect bole, gave a fair measurement of no less than 18 feet 2 inches in girth, at five feet from the ground. But even this tree was surpassed by one in much more perfect condition on the lower ground, for this absolutely girthed 21 feet 10 inches, at five feet from the ground, though lower down it was somewhat less. These trees are certainly the finest cedars in the county, and there is some reason to believe that they were planted about the year 1788, when the cedar tree seems to have been first introduced into Herefordshire. The beech trees at Shobdon are also very fine; but alas! upon some of them, the *Agaricus (Armillaria) mucidus*, in all its elegance, met the sharp eyes of the botanists, for it but too surely indicates the commencement of decay. There is a very fine yellow horse chestnut *(Æsculus flavus)* on the lawn, in close approximation with a beautiful deciduous cypress; it is, however, only mentioned now to note how completely the tree has become the prey of the mistletoe. All the other trees and lawn attractions must be passed by, for the "Fungus Foray" was the real purport of the gathering—indeed it had begun already, for several of the gentlemen were hunting like truffle dogs under the beech trees.

The visitors quickly spread over the hill, the ladies and the more infirm of the party taking the carriages, which had been thoughtfully provided for their use, Lord Bateman himself acting as chief guide on horseback. All steps were first turned towards those well-known arches of so great an archæological interest, which stand in the park. It is, however, sad to see them there, exposed to the weather, which must sooner or later efface all memorials of that very early Irish school of design of which we have but few samples left. Not that the fungologists were sad, for here the ground was strewed all over with the orange tawny caps of the orange chanterelle *(cantherellus aurantiacus)*, which grows so gracefully and has usually gills of an orange colour so deep and pure, that it is impossible to help picking them again and again in simple admiration. Many of these plants,

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however, showed pale gills, which are much more rare, though by no means so pretty. Among the grass here was also gathered *Russula alutacea* and *R. rubra*, and several of the milky agarics, *Lactarius insulsus rufus*, and *subdulcis*. The route was then taken for the park, and all the varied and extensive landscapes afforded at every turn were duly admired, the deer grouping themselves in the foreground as if with design. A sudden stop was soon made to gather a fine specimen of *Polyporus lucidus*, which Mr. Berkeley spied growing from the bole of an oak. When the woods at the foot of the hill were reached the carriages were left, and the hunt for funguses became general. It would be long to tell of all the various "finds" the day afforded, for the woods on the brow of that long hill are rich indeed in rare kinds. Here was found for the first time in Herefordshire, *Clitocybe clavipes*, a graceful agaric, with the stem thick at the base as its name indicates: the little bird's nest fungus *Crucibulum vulgare*, whose spores resemble eggs in a tiny nest, was also found. There was the beautiful fly agaric *Ag. (Amanita) muscarius*, which the Russians love to get tipsy upon, with its bright crimson top speckled with white; the rare *Amanita mappa;* and the graceful but foul-smelling *Amanita phalloides*. Dr. Bull gathered a pretty specimen of the rare *Leptonia euchrous*, with its bright violet gills. Mr. Griffith Morris found the curious *Marasmius Hudsoni;* Mr. Howse, *Boletus striœpes;* and Lord Bateman himself—a fungologist for the nonce—gathered a specimen, fine and rare, of *Boletus badius*, which was most carefully treasured to sketch in memory of the foray. *Boletus edulis*, edible as its name implies, was found in abundance, and some of it gathered for cooking; and many other interesting kinds, whose value a close study is required to determine. The view from the summit of the hill, on the top of the avenue, was very varied and extensive. The height of the hill at this point was pronounced by one of the gentlemen who had carefully observed his pocket aneroid before starting in the morning, to be about 700 feet above Hereford, or nearly 900 feet above sea level; and this is probably a close approximation, for very careful observations made six years ago proved the camp on Deerfold Forest—the hill just across the valley beyond—to be 913 feet above sea-level. From this point the party separated into groups, and pursued their several ways through the extensive woods; but, wander as they might, absorbed in fungus search, no critical corner was ever reached, but a keeper was at hand to direct them aright. Thus it came to pass that in proper time all reached the mansion to be refreshed by the hospitality which awaited them there. The day was one of perfect enjoyment throughout. The weather was brilliant; the scenery most beautiful; and the kindness and attention to every one present throughout the day, was such as to make it ever remain a bright spot in the annals of the Woolhope Club. One of the gentlemen, who adds to his botanical science skill in photography, did not omit to take several pictures. It is hoped that these will turn out satisfactorily, and thus give an abiding record to all the visitors present of the happy time spent in the "Fungus Foray" at Shobdon.

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FUNGOLOGICAL DIFFICULTIES,

By the Rev. J. E. Vize.

No person can ever commence the study of fungi, or its near relations in science without expecting to find difficulties ahead, and those of no slight kind. And those difficulties for a considerable time increase, until a substratum is laid on which work may be commenced with a certain feeling that every addition to knowledge is one point gained towards dispelling the cruel thickness that seemed to be in front of the work. It has been a source of surprise to me more than once to find men who get warm within themselves and feel a sort of elasticity of spirits when they get from a friend a little insight into the splendid way in which the Great God has created the lower forms of vegetable life, and yet they drop off all at once. You may hear of them as enthusiasts for a time, you see their names in print, and although alive they are no more even as amateurs to be heard of. They are dead to fungoid life, and nothing like so serviceable as the dried specimen in the herbarium. In this respect the student of Cryptogamic life shows poorly by the side of the student of Phanerogamic life, the latter gains more in proportion to the former, in other words, let ten young men begin flowering plants, most of them will keep to their recreation, probably none will entirely give it up. But where will you get ten students to stick through thick and thin to plants, many of which are not to be appreciated without considerable magnifying power? Few of which have gorgeous colors to attract the eye and fix the thought upon their glories? All of which begin to be learned by sheer hard work aided no doubt in many instances by natural taste for them, nevertheless never helped from infancy upwards by the line upon line principle. A child is allured by the tints of flowers and their smell, and knows without trouble to itself a primrose from a violet, a cabbage from a box tree or hollyhock. But it is not so with cryptogamic life. If *Agaricus Campestris* were not an article of merchandise and moreover nice as a dish and good for making ketchup, I suppose not a single fungus would be known to the general multitude of men and women, and even with *Agaricus Campestris* how puzzled people get with some of the varieties, testing them with salt and having sundry misgivings for fear they should make a mistake and be poisoned. Difficulties there are then by nature of unusual greatness, and they increase for a time. Flowers fascinate, fungi and allies do not allure onwards. Besides a phanerogamic botanist has vastly more friends to whom he can appeal in a difficulty, vastly more botanical works he can consult. Look by the side of him at the fungologist, so few men are there who have gone through the years and years of study and become standards of appeal that there is a shrinking back from troubling them. I know this must and does and will exist largely, not that on the part of the person consulted there is likely to be entertained any other idea than that he is glad to give any help in his power. Still the feeling does come that a severe trespass is being made upon valuable time, that there will be few things quite new

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that many will be common, and that after all expense is entailed on others which it is not fair to incur. Possibly it is this which has induced some of our best workers to bracket their names in pairs. Messrs. Berkeley and Broome, Messrs. Phillips and Plowright, Messrs. Cooke and Peck. The difficulty to me seems to be in attaining just that amount of study and friendship which will give and get from another instruction without the sensation of intrusion. The finding of specimens to a beginner is very very easy, he cannot help obtaining them, fungi being almost ubiquitous, but the naming of them is a harder matter by far. Give a young student a *Helminthosporium Smithii* (B and Br)—a *Clasterisporium Vermiculatum* (Cooke) and he must want help, so he will to distinguish a *Clavaria* and *Geoglossum* at first sight. See how even the advanced mycologists, Mr. Worthington G. Smith and Dr. De Bary have differed about *Peronospora* and *Pythium*, the former to all our English minds I suppose taking the victor's crown. May all our rivalries in science go on as that seems to have done so satisfactorily, and may as I believe to be the case, an anxious desire always be shown to get at the real settlement of the case by solid experience, with what we do not always get in religion and politics, namely mutual forbearance and unbounded charity.

But whilst speaking about contrasts in fungi, we must not forget that some of the plants are not difficult for a beginner to decide, at all events as to the genus to which they belong. Who that ever saw a *Pestalozzia* with its beautiful crest would fail to remember the aristate head thereof, and assign to it its proper place? Who that ever saw a *Puccinia* would give it a spot which generically did not belong to it, unless perhaps he had been reading that splendid work "The Scottish Cryptogamic Flora," and turned to *Puccinia Fabæ*, about which Dr. Greville strangely in error says, "This is the only species I have observed in this country with unilocular sporidia." The fact is they are not *Puccinia* at all which has uniseptate spores, but true *Uromyces*. I have searched most diligently and enquired very anxiously at home and abroad, and never could hear of a *Puccinia* on the Windsor Bean.

There is another grievous difficulty which besets us all, but more especially those who are not rich, and very very few working fungologists are rich, certainly not when they begin the study. I refer to the absence of really standard works with reliable plates or figures drawn to life when large to the eye, to scale when microscopic. It has become a matter of difficulty to hear of any one possessing the works of Sowerby, Corda, Bolton, and others, and if a second-hand copy be in the market its price is gigantic, and the demand for it equal to its price. To sit down and copy by drawing or tracing these books, if they are to be obtained by borrowing, implies an employment of time which is very tedious and might be better occupied. If the original plates of these authors be in existence (who knows where they are?), could not some copies of them be made afresh? But then comes the question of return as a cash investment. The cryptogamic publication of books is at best uncertain. To publish old books would not pay, because older students here and on the continent may have them. Very young beginners

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would rather begin quietly. Certainly the difficulty about authentic books is enormous. You can get Phanerogamic books, Sowerby's English Botany for instance, with a coloured plate of every flowering plant, for a certain number of sovereigns, or Bentham's British Flora uncoloured, for the same amount of shillings; but who shall give a notion as to the cost of the valuable books and plates scattered here and there which bear on Cryptogamic botany taking the Fungi alone? The difficulty to a beginner would be enough to astonish him if only he could realise it.

Then look at the nomenclature of Fungi, how one author of eminence calls a certain growth by one name, another calls it by another name, and very naturally so too, for this branch of study has not arrived at so perfect a state that we can detect the various steps of growth from the juvenile form to full ripeness. You know for a certainty that if life be continued the infant of to-day will be the man by-and-bye; but the various connecting links in the chain of growth in Fungi are by no means so indisputable. Perseverance coupled with other constitutional ingredients are needed before you can convince yourself and others that a *Cladosporium* will necessarily become a *Sphæria*, that an *Œcidium* must develope into a *Puccinia*. Because one *Œcidium* has been traced upwards and onwards, you must not with the Germans conclude that all *Œcidia* do the same. Analogy makes suggestions, but suggestions are not infallibilities. It is the jumping at conclusions which damages very considerably the good cause of science. As study is prosecuted by the lovers of fungology it is to be hoped that the nomenclature of Fungi may become easier, but it wants very exact work, it wants the accumulative results of the cleverest minds in the wide wide world, it wants a thorough knowledge of the gradual growth of all the Fungi, just as men know the growth of oaks from acorns. The gradual developements of all the microscopical fungi must and will be severe, we cannot see them without artificial help, and of course cannot be always examining them. If the study of the anatomy of a caterpillar be worth a life time, what becomes of fungology? Its difficulties must be immense and will be. The nomenclature will rectify itself by degrees, retaining however its classical terms. Let each of us try and contribute our quota fragmentary, though it may be to the ease and benefit of those who may reap our labours when our work is done. And whilst we look at these and kindred trials, we may positively start upon the conviction that not a single growth is a growth of chance, all grows on fixed laws decreed by God. Our superstructure may be uncertain, but certain is the primary step from which fungoid life starts. We may go astray through imperfect knowledge and want of clear insight, but we may be sure that our errors are from the feeble powers man now has. For the present we know that fungoid life serves a very high purpose, as does all the scheme of creation. Everything is necessary, and when we attain a higher state of perfection possibly we shall wonder at the diminutiveness of our study now. Still for the present we say about all forms of life, "For God's pleasure they are and were created," and we may comfort ourselves by the assurance that no study on earth will attain an easy and infallible

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road, for with difficulty each step has to be thoroughly investigated and "sought out of them that have pleasure therein."

I must stop, omitting many a branch of trouble to the student, not however without the hope that as the number of Fungologists increases—and they certainly do increase—that some of the difficulties named will decrease, and not without the earnest wish that in admiring the lower forms of vegetable life, we may remember they may be made and ought to be made stepping stones to that higher form of life—namely, the angelic—which I am sure we shall all hope to have by-and-bye in exquisite happiness.

ON THREE NEW HEREFORDSHIRE PEZIZAS,

By William Phillips, F.L.S.

The fungus flora of Herefordshire, thanks to the labours of the Woolhope Club, promises to be the most complete of any part of Britain. Every year is adding to the already long list of species others new to science, or, what is nearly equal in interest, species that have not been previously recorded as British. The genus *Peziza* consisting mainly of minute forms does not command the general interest of the members of the Club as do such genera as *Agaricus*, *Boletus*, and *Polyporus*, but for elegance of form, beauty of colour, and complexity of structure the *Pezizæ* are not surpassed by the members of any other genus in the great family of Fungi. I am hopeful therefore that the observant members of this Club will not overlook these smaller plants under the impression that size is the true indication of importance. Much good work has already been done by my friend Mr. Renny in the genus *Ascobolus*, several new species having been detected by him in this county and described in our transactions, and no doubt much more work remains to be done before we can consider we have exhausted the resources of this rich mycological district.

My object on the present occasion is to call your attention to three species of *Pezizæ* discovered in the vicinity of Hereford by our esteemed president Dr. Chapman. The first is *Peziza viridaria* B and Br. originally described in the Ann and Mag. Nat. Hist. No. 555. This species was so named because it was found growing on the wall of a greenhouse at King's Cliffe. The specimens collected by Dr. Chapman were found by him on a damp wall of the Hereford Asylum and given to me two years ago. The cups vary in size from $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter, they were seated on a thin lair of cottony mycelium spread on the surface of the plaster, and were of a watery brown colour. (See Cooke's Handbook of British Fungi, vol. ii. p. 672, for a technical description of the species). Finding no published record of the occurrence of this fungus since 1845, I presume it is rare.

The second species is *Peziza Tectoria*, Cooke. This was first described by Dr. Cooke in "Grevillea" (a quarterly Journal of Cryptogamic Botany), vol. iii.,

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THREE NEW HEREFORDSHIRE PEZIZAS,

By William Phillips, F.L.S.

EXPLANATION OF FIGURES.

Fig. 1. *Peziza viridaria*, B and Br.

A. Natural size of the fungus.

B. A perpendicular section of a cup.

C. Ascus and paraphyses magnified about 400 times.

D. Sporidia removed from ascus. ·010 × .005 mm.

Fig. 2. *Peziza tectoria*, Cooke.

A. Natural size of fungus.

B. Section of a cup cut perpendicularly.

C. Ascus and paraphyses magnified about 400 times.

D. Sporidia removed from ascus, ·015 × ·007 mm.

Fig. 3. *Peziza domestica*, Sow.

A. Natural size of the fungus.

B. Four cups magnified.

C. White hairs from a cup magnified about 400 times.

D. Ascus and Paraphyses magnified as above.

E. Sporidia separated from the Ascus. ·015 × ·007 mm.

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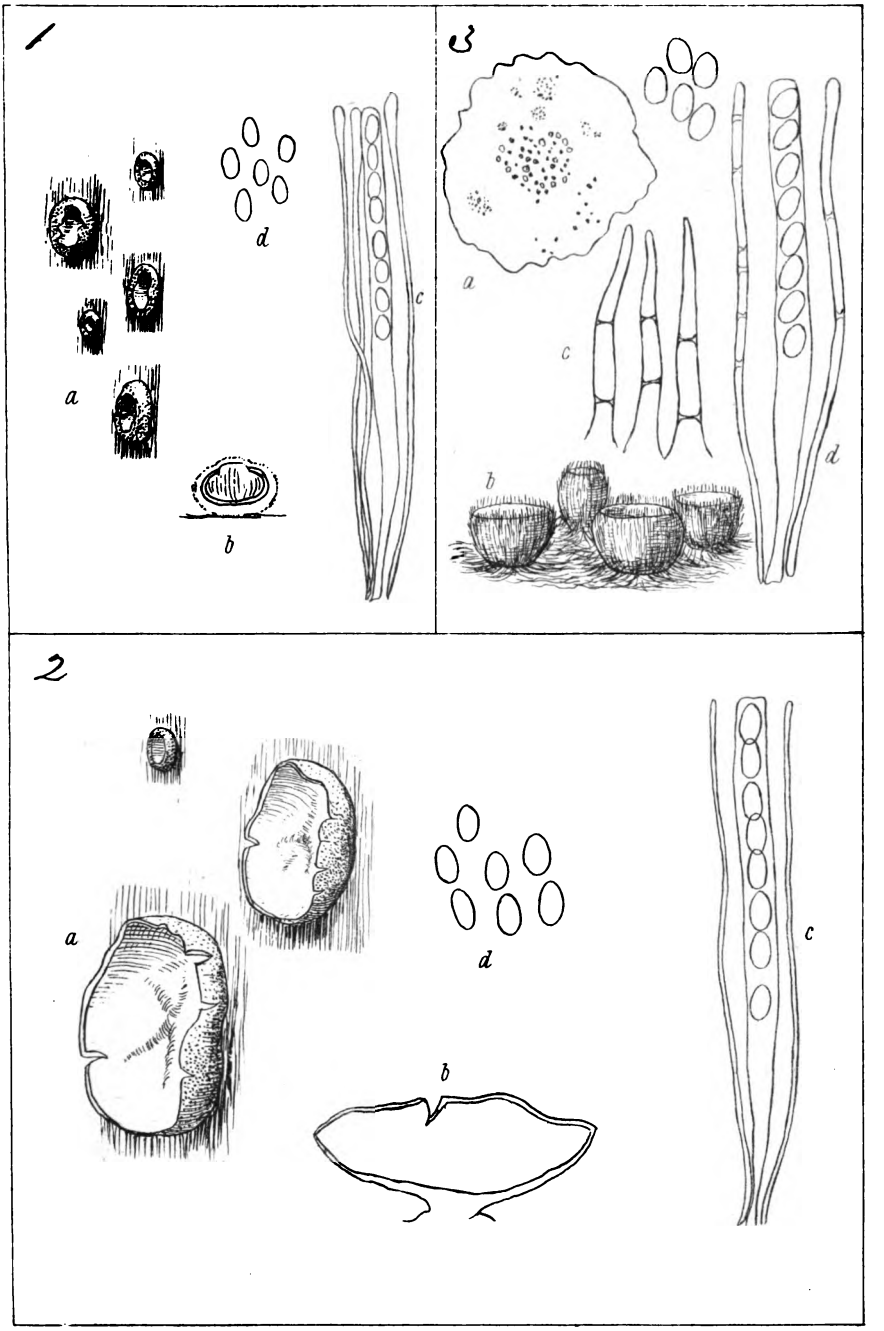

HEREFORDSHIRE FUNGI.

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p. 119, from a specimen in the Herbarium of the British Museum sent by me seven years ago to the office of the *Gardeners' Chronicle*, and referred by the Editors at the time to *P. viridaria B and B.* There is a great similarity between these two species, both grow in similar situations, and often in company. It was found by Dr. Chapman in the Asylum on the damp wall before alluded to, which the Dr. tells me in a spirit of unscientific glee unbecoming the president of our distinguished Club, he has succeeded in rendering perfectly dry, so that it will produce no more fungi! The cups of this species measure from one inch to one and three-quarters of an inch across, have a short stem, are rough outside with coarse granules, which drop off in old age, and spring up from a web of mycelium overspreading the plaster. For the minute points of difference warranting Dr. Cooke in regarding this as distinct from *P. viridaria*, I must refer you to the description in Grevillea and the drawings now placed before you.

The third species I regard as by far the most interesting addition to the Herefordshire Flora on account of its being a rediscovery of a plant after a lapse of more than half a century; it is *Peziza domestica, Sow.* Its history is as follows: In Sowerby's great work on British Fungi, published in 1809—a work, of which as Englishmen we may well be proud, very costly and scarce—is figured *P. domestica*, accompanied with the following description of its place and mode of growth on damp walls:—"It first clothes the places that have been wetted with a fine cottony or membranaceous film nearly as white as the plaster, which is in a short time partly covered with salmon-coloured knobs. These at length form a kind of upright Peziza externally villous." Sow. The illustrious Fries, in his Systema, vol. ii., p. 107, places it in the section *Tapesia*, but afterwards in the Elenchus he appears to have considered that it was very closely allied to *P. diversicolor* which stands in the section *Sarcoscyphae.* The Rev. M. J. Berkeley knowing the species of Sowerby more intimately retained it in *Tapesia* in the fifth vol. of "English Flora," appending the following remark: "The dried specimens do not retain any of their villosity, which consequently though represented as erect must be extremely delicate. I have thought proper therefore to retain it for the present in the place originally assigned by Fries, notwithstanding the fresh observations in the Elenchus as to its identity with *P. diversicolor.*" I am able to say after a careful and leisurely examination of Sowerby's original specimens kindly permitted me by the Rev. M. J. Berkeley that the propriety of the views expressed above and the course he there took are fully justified. To me it is evident that Fries being guided by Sowerby's figure not having seen the plant itself mistook the character of the hairs (if such they can be called) clothing the cup. Having regard to the figure they appear rigid and coloured, somewhat like those of *P. stercorea*, P., whereas they must have been very slender, delicate, colourless and deciduous, similar to those found on *P. ascoboloides*, Bert. and *P. subhirsuta.* Such hairs are often absent in dried specimens, especially when they have been long in the herbarium. The propriety of retaining it in the section *Tapesia* is fully warranted, for even to this day the cottony subiculum surrounds the base of the cup and when fresh must have been nearly as conspicuous as in *P. cœsia.* The specimens of this

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Peziza found by Dr. Chapman, and forwarded to me in May last, correspond exactly with Sowerby's original specimens. They grew on the perpendicular surface of the damp plaster wall already alluded to, presenting the appearance so faithfully described by Sowerby of a number of minute salmon-coloured knobs not larger than a pin's head, resting on a thin white cottony film spread on the plaster. By the aid of a pocket lens they can be seen when moist and fresh to be clothed with fine white transparent hairs which collapse in drying. The accompanying figure will convey a better idea than any verbal description.

STRUCTURE AND FUNCTIONS OF PARAPHYSES,

By M. C. Cooke, M.A.

In the following observations all illustrations are drawn from the *Discomycetes* for the sake of limiting the field of research, and because on other accounts a larger variety of specimens came under observation than could have been anticipated in other sections of the *Ascomycetes*. As no essential differences can be predicated in the structure and functions of the paraphyses, this will not effect the general conclusions.

It is scarcely necessary to allude to the structure of *Discomycetes*, as exemplified in *Peziza*, which may be accepted as the type. The cups, at first closed, have externally a dermal series of compact cells, differing from those beneath them, and often furnished with dermal appendages, such as hairs or furfuraceous cells. Beneath the dermal series lie the mesothalamial cells, in most instances regular and uniform, but when verging on *Urnula* and *Cenangium*, elongated. tough, and more or less fibrous. A third series of smaller cells are superimposed, but the one so gradually merges into the other that, usually, the exact point where one series ends and the other begins cannot be determined. This third series is the subhymenial tissue on which the fourth or final series lining the interior of the cups is based. It is to this fourth series that our attention must be specially directed. If a section through a cup of one of the larger species of *Peziza* be made it will be seen that the interior, or fourth series which we may term the *hymenium* and which terminates in the disc of the cup has quite a distinct structure from any of the other series. It is composed entirely of elongated parallel cells, which have their base on the subhymenial tissue and their apex in the disc. From the earliest to the latest period in the history of the cup this distinction prevails. At first the hymenial cells are scarcely distinct, but they soon become evident as long filiform cells lying parallel to each other, amongst which at a later period other and broader cells are generated by growth upward from the subhymenial tissue. These latter cells are the asci, the former being the paraphyses. It will be noted here that the fourth or hymenial cells are a portion of the vegetative system of the cup, being in fact the inner series of the cup cells. In the same manner they are an integral portion of the club in Geoglossum, and form the superior series before a single ascus is developed from the subhymenial tissue. This is not by any

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STRUCTURE AND FUNCTIONS OF PARAPHYSES,

By M. C. Cooke, M.A.

EXPLANATION OF PLATE.

1 Fusiform paraphyses of *Peziza virginea*.

2 Linear paraphyses of *Peziza*.

3 Curvate paraphyses of *Peziza sanguinaria*.

4 Curvate paraphyses of *Geoglossum hirsutum*.

5 Curvate paraphyses of *Geoglossum Peckianum*.

6 Clavate paraphyses of *Peziza fusicarpa*.

7 Clavate paraphyses of *Peziza tetraspora*.

8 Clavate paraphysis of *Peziza spissa*.

9 Capitate paraphyses of *Peziza leporum*.

10 Dissilient paraphyses of *Patellaria indigotica*.

11 Capitate paraphyses of *Peziza sterigmatizans*.

12 Capitate paraphyses of *Peziza fibrillosa*.

13 Dissilient paraphyses of *Patellaria clavigera*.

14 Capitate paraphyses of *Peziza jungermanniæ*.

15 Dissilient paraphyses of *Patellaria hyalosperma*.

16 Furcate paraphyses of *Dermatea Houghtoni*.

All figures magnified 500 diameters.

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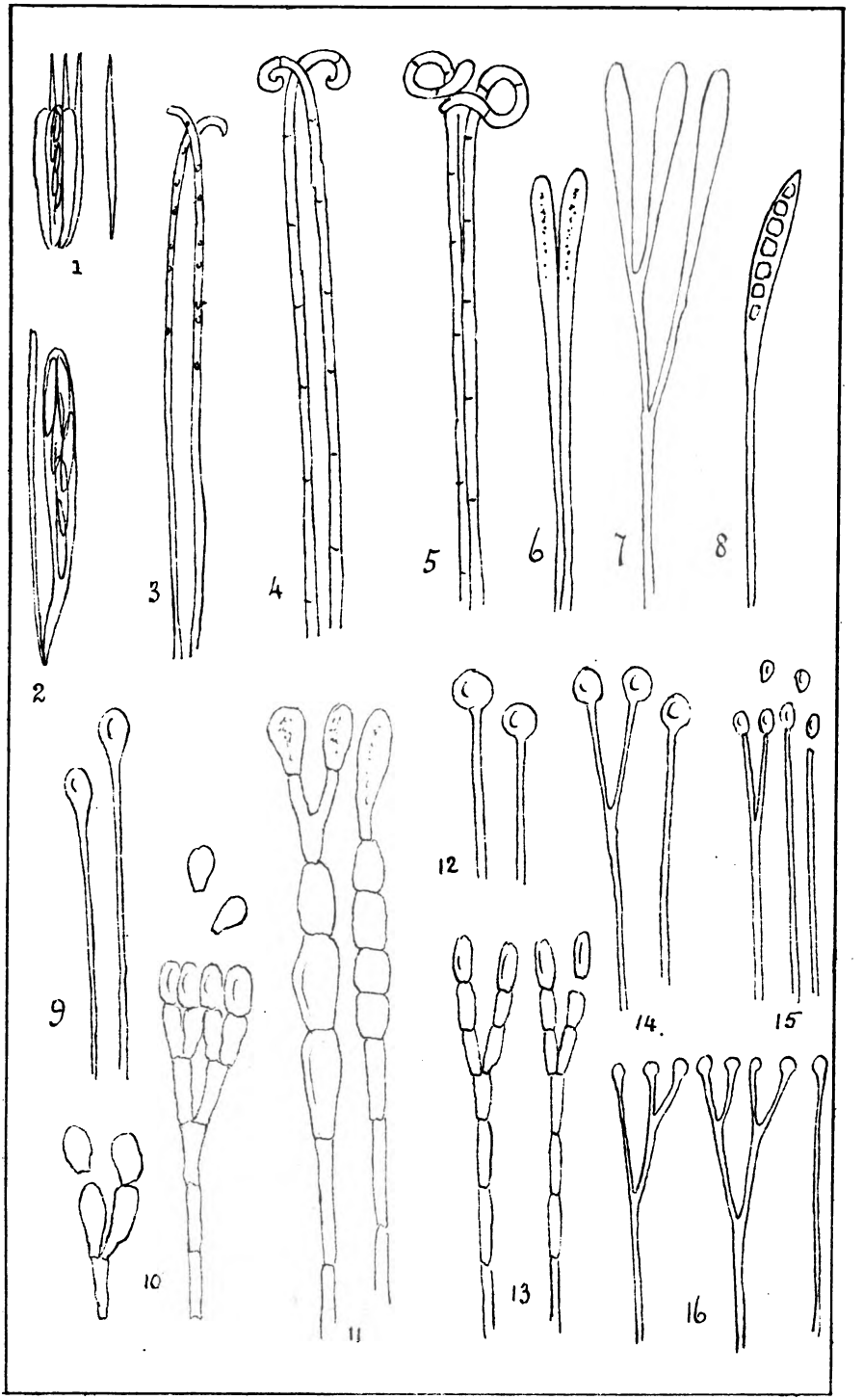

PARAPHYSES.

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means a new view since all physiologists who have directed their attention to the development of the cups or the hymenium in *Peziza* or *Ascobolus* represent the asci as a subsequent and consecutive growth from the subhymenial tissue upwards amongst the skeleton threads of the disc structure.*

Linear paraphyses are the simplest form. They consist of a slender cylindrical cell of equal thickness throughout. This form prevails almost entirely in *Mollisia*, and very largely in *Dasyscypha*. Amongst the larger *Peziæ* of the section *Aleuria* they are comparatively rare. In *Hysteriacei* this form of paraphysis is not uncommon, and amongst the *Syhæriacei* it seems to be the most common form. Sometimes they but little exceed the asci in length and then remain perfectly straight, but when considerably exceeding the asci the tips are often more or less curved as soon as they are set free so that the retractile tendency can exhibit itself. Such paraphyses are usually colourless and without contents. At times a row of nuclei exhibit themselves or the threads become septate. Septation may be perfect, as when a diaphragm connects the opposite walls or the eudochrome is divided. The latter condition is very difficult indeed to distinguish in the slender linear Paraphyses, but is not uncommon and may be well studied in some of the larger species with *clavate paraphyses*.

Clavate paraphyses are those which expand in their upper portion into a more or less clavate form. Sometimes the expansion is very gradual, occupying the upper half of the paraphyses, at others it is more abrupt, and at least three-fourths of the paraphysis remains linear. Gradually this form merges into the capitate form, and usually the thickened apex is filled with a granular plasma. In many of the species of *Peziza* with a highly coloured disc, as in the red species of *Humaria* and *Sarcoscypha*, in which this form prevails, the endochrome is brightly coloured. These paraphyses are often septate, sometimes pseudo septate, and rarely furcate. It may be noted here that we have every reason to believe that the general form of the paraphyses is as constant in any given species as the form of the sporidia, and deserves consideration in the discrimination of species. It has been of late very much the fashion to construct new genera on the form of the sporidia alone. It would be just as safe to construct them on the characters of the paraphyses, and equally as reasonable.

Capitate paraphyses are those in which the apex is suddenly expanded into a pyri-form, obovate, or subglobose head. It is perhaps not a common form, but it may be met with in *Ascobolus*, especially of the section *Ryparobius* in *Geoglossum viscosum*, *Peziza fibrillosa*, *Peziza leporum*, and some others. This head contains at times a single large globose nucleus, at others it contains a granular protoplasm. A remarkable instance of this kind of paraphysis is to be found in *Peziza jungermanniæ*, in which the paraphyses seem to be coloured of a verdegris green, but as it is appears to us much of this colour is due to the gelatina hymenia which is greenish, as in *Peziza Phillipsi* it is of a beautiful amethystine hue. If either of these species are examined in a fresh state, and the section plentifully washed

*The suggestion that the asci arise from the subhymenial cells, from certain larger cells (the *scolecite*) has not been satisfactorily confirmed.

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with spirit, nearly all the colour is removed, and it can be seen receding before the spirit, if the latter be added whilst the slide is under the microscope. In most instances, when the paraphyses are internally coloured, the plasma is distinctly granular, whilst in these two species it is not so, which strengthens the conclusion that most of the colour belongs to the hymenial gelatin, and this again supports the view hereafter advanced that the paraphyses are surrounded by a gelatinous fluid.

Acuminate or fusiform paraphyses are not so uncommon as at first might be supposed. Although confined absolutely as far as at present known to minute species of *Peziza*, and the single species of *Desmazierella*, there can be do doubt of their form. Mr. Phillips and myself have detected them in several species and usually of considerable length relative to the asci which accompany them. They are one very distinctive feature in the closely allied species *P. nivea* and *P. virginea*, since they are found in *P. virginea* and not in *P. nivea*, as I pointed out to my friend Mr. Phillips not long since, and requested him to verify my observations. I may add that in most novelties of this kind I have not relied solely on my own examinations, but have solicited his aid for verification. These paraphyses are slender, thickest in the middle, and diminished towards either extremity, the apex being acutely pointed. Amongst others they may be seen in *Peziza sulphurella*, *Peziza virginea*, *Peziza brunneola*, *Peziza virginella*, *Peziza echiulata*, *Peziza albopileata*, *Peziza patula*, *Peziza fuscidula*, *Peziza rosea*, *Pezizi littorea* of Rehm, *P. Schwanitzii*, *P. palearum*, *P. cephaloidea*, *P. apala*, *P. conformis*, *P. albotestacea*, *P. pollinaria*, aud *P. mavginata*. No instance occurs to me outside the section *Dasyscypha*.

Branched Paraphyses are to be met with of all these four primal forms except the last, and I know of no instance in which an acuminate paraphysis has been seen branched. Usually the branching is a simple furcation, with the branch reaching to the same height as the branch stem. Linear paraphyses may be seen branched in *Peziza institia*, and clavate in *Peziza humosa* and *P. tetraspora*, capitate in *P. junger mannæ*. Examples of more highly developed paraphyses are sometimes met with. Messrs. Berkeley and Broome have indicated some. Mr. Gerard has sent me figure of paraphysis from *P. umbrorum*, and Mr. Smith has figured a very nodulose paraphysis in *Peziza macrocalyx;* but I must confess that in my experience such instances are the exception and exceedingly rare. *Peziza Sterigmatizans* and *Peziza apophysata* are two notable exceptions. It appears to me that they usually occur in old paraphyses, it may be by a species of aftergrowth, when by the explosion of the asci there is left more room for a lateral development. I have looked for them carefully in *Peziza humosa* and in a portion of Mr. Smith's own specimen of *Peziza macrocalyx* without success. That such forms have been seen I do not for a moment doubt, still I cannot regard them as other than abnormal conditions.

Dissilient Paraphyses are those in which the upper joint or joints when mature break off and give a pulverulent appearance to the disc. It is not uncommon in *Patellaria* and *Tympanis*. In *Patellaria cavispora* it has been noticed

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by Messrs. Berkeley and Broome, but they do not mention it in *Pat. atrata*. I have observed it also in *Patellaria oleosa*, in *Patellaria indigotica*, and in a very curious little *Patellaria* sent me from Italy under the name of *Patellaria hyalosperma*. It may be seen also in *Tympanis picastra* and *Tympanis Ravenelii*. In *Dermatea* and *Cenangium* the same phenomenon probably occurs, but I have not had the leisure to pursue the investigation.

These remarks must be accepted as suggestive rather than exhaustive, but I think that I have alluded to the chief typical forms of paraphyses, and to these it appears to me that all the variations may be referred.

The FUNCTIONS of paraphyses appear to be mainly the protection of the fructiferous organs. Surrounding the asci they seem to stand in the same relationship to them as in flowering plants the corolla bears to the essential organs. They constitute in the earlier stages of growth the entire hymenium, aud in this stage form a disc with their upper extremities, whilst their parallel sides, immersed in a gelatinous fluid, afford ready channels for the growth and development upwards of the sporidiferous asci. It can readily be imagined that such a structure affords very great protection for the asci during growth. It can hardly be supposed that delicate asci could successively be produced on an entirely exposed surface without great risk of destruction, but by means of *this* arrangement they thrust themselves upwards through protecting channels, lined everywhere with a lubricative fluid, so that their movements are facilitated as well as protected. It is an undoubted fact that all the asci of an hymenium are not developed at once, but proceed for some time in a regular succession from the subhymenial tissue. At first the asci are slender, gradually increasing in volume as they rise, but until they have attained their full height their contents are plastic and granular. Having approached their adult stature, the differentiation of the protoplasm takes place; gradually the outline of the sporidia is indicated, commencing at the summit of the ascus and progressing downwards, and finally the sporidia are formed. It is well to bear in mind that the terminal sporidia are the first to be matured, and this is conspicuously evident when the sporidia are ultimately coloured; under favourable circumstances a delicate gradation in colour will be observable downwards through the whole series. It has already been remarked that it is of rare occurrence that the asci should reach by their apices the surface of the disc. As a rule the paraphyses being the longest extend above and still protect the asci. The swollen, or clavate tips, compensate to some extent for the space occupied below by the asci, and the surface is still maintained impervious. In cases where the tips of the paraphyses are not clavate, but filiform, they are not unusually branched in their upper portion, which only adds to their volume, and in some cases the extremities are bent, curved, circinate, or interwoven, so that still the whole disk is covered, and no openings left above the apices of the rising asci. Undoubtedly the apices of the asci are always most free from pressure or restraint, which is essential to the free discharge of the mature sporidia. It may sometimes be seen on the field of the microscope that as a mature sporidium is expelled from the apex of its ascus the clavate paraphyses which surround it

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are parted by the force of the eviction, but immediately resumed their old position again with a jerk, as if impelled by their own elasticity. Here then we have a primary function for paraphyses. They form the parallel thready cellular tissue of the hymenium and complete, so to speak, the vegetative structure of the plant, previous to the development of the reproductive organs; they, moreover, by their structure serve as free channels along which the delicate asci may be developed without risk of distortion or injury; and by their peculiarities of form, they still maintain an impervious disc, notwithstanding the great lateral increase of volume below, and thus prevent the speedy evaporation of the watery fluids so essential to spore production.

It may be observed here, in passing, that the disc is most exposed to the risk of too great evaporation, since the exterior of the cups is protected by various contrivances and sealed against any loss by transpiration.

What may be the special functions of the curious pointed fusiform paraphyses, found in several of the minute species of *Peziza* we have not as yet been fortunate enough to discover. All the species in which this form of paraphysis is found are very minute, and the difficulties in such an investigation are consequently great.

It has been remarked that some of the forms of paraphyses throw off their apical cells, which cover the disc with a mealy coating. Hitherto we have not been successful by any means at our disposal in compelling these cells to germinate. Indeed we have no grounds whatever to consider them of the nature of conidia, but only as free cells cast off for some purpose from the tips of the paraphyses. As far as our observations have led we are disposed to regard this as a subsidiary mode of protecting the disc from radiation, and thus retaining the moisture so essential not only to the production, but also to assist in the expulsion of the sporidia.

The instances in which the phenomenon here alluded to takes place are almost wholly confined to species the discs of which are black or dark coloured, and are not found in the true *Peziæ*, which contain a large proportion of water in their composition, but in such genera as *Patellaria* and *Tympanis*, which are comparatively waxy and dry, and consequently wherein greater economy of the fluid contents of the hymenium is essential. This, however, is merely a suggestion, since no facts have come to light which directly establish the conjecture, except the circumstantial evidence alluded to.

Whether threads are produced at any time, or in any species, intermixed with the paraphyses, which threads develope bodies of the nature of conidia or spermatia, is an open question. At present I am not prepared to give an opinion. In a very old specimen of *Helvella infula* I have found cylindrical bodies which greatly resemble conidia, and in other species I have seen occasionally spermatoid bodies, which as yet I am unable to account for. This remark is suggested in order to indicate one direction in which further observation is desirable.

Finally, some observations are necessary on the supposed functions

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attributed by some authors to paraphyses. It has been affirmed, on the faith of a few facts which seem to point in that direction, that paraphyses are probably abortive asci. It has been observed in the genus *Tympanus* that in one species one or two isolated sporidia were found enclosed within paraphyses associated with the ordinary octosporous asci. Two or three facts of this kind may give plausibility to such a theory; but on the other hand it must be remembered that evacuated asci collapse and become as attenuated as paraphyses. Asci, from which a portion of the sporidia have been ejected, will sometimes be observed with the remaining two or three sporidia collected near the summit, whilst towards the base the walls of the asci are contracted and attenuated so as to present an abruptly clavate appearance. If it is not conceded that in the instances cited such a phenomenon has been mistaken for one or two sporidia enclosed in a paraphyses, is it not equally probable that some asci may become abortive, and being mixed with the paraphyses are indistinguishable, unless specially observed with this view. It is contended that abortive asci do exist contemporaneously with paraphyses and with gravid asci, and that these abortive asci are structurally and functionally distinct from the paraphyses, they do not exceed asci in length, though less in volume, whereas paraphyses are much longer than the asci in many instances, but usually somewhat longer. Again, paraphyses are sometimes more or less clavate at the tips, but apparently barren asci would be cylindrical. The fact that special functions belong to asci would militate against the assumption that they are at the same time degraded from another function. It would seem to argue strongly against the hypothesis that paraphyses are abortive asci, when the structure of the two as well as their functions are borne in mind. Paraphyses are developed prior to asci, they usually exceed them in length, they are often septate several times, sometimes branched, often expanded at the apex and enclosing coloured granular protoplasm, even when the sporidia are wholly colourless, and it is not unusual for the ultimate cells of the paraphyses, not only to become deeply constricted but also to break away and lie on the surface of the hymenium like a fine dust, as in some species of *Patellaria* and *Dermatea*. All these phenomena are so distinct, that if paraphyses are really *abortive* asci they must be something *more*, and indeed *metamorphosed* asci.

If the phrase "abortive asci" has been applied to paraphyses in the same sense as stamens in the Phanerogamia are regarded as metamorphosed leaves, then we object only to the term, and not to the theory, and would submit that "metamorphosed" asci represent the idea better than "abortive" asci, which latter is liable to misconception.

Doubtless the simplest form of fungus is a simple reproductive cell, beyond this we have the vegetative system represented by a thread and the reproductive by a spore. In *Discomycetes*, the simplest form consists of an ascus borne on a vegetative thread or mycelium as in *Ascomyces*, advancing from this we find the aggregated asci circumscribed by a pseudo-receptacle formed from the changed substance of the matrix, and then we encounter paraphyses mixed with the asci, ultimately the hymenium is enclosed within a distinct receptacle. If typically we

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regard a fungus as consisting of mycelium and fruit, then it may be permitted to speak of stipe, stroma, or receptacle as expansions of the mycelium, and, accepting *Ascomyces* as the type, paraphyses might be regarded as metamorphosed or atrophied asci. There would be somewhat of poetical license in such a course, but if understood as only to be accepted in an æsthetic sense there would perhaps not be so much ground for complaint. If, on the contrary, it should be contended that paraphyses are merely the raw material from whence fruitful asci are produced, or that they are nascent asci which peculiarly favourable circumstances might stimulate into fertility, then we cannot accept the theory until stronger evidence can be educed in its support. We have already expressed an opinion of the functions of paraphyses, hence it is unnecessary to prolong a discussion of what they are *not*. Although there is nothing sensational or startling in the acceptance of a theory that certain organs found performing certain functions, were *intended* to perform those functions; and that performing those essential functions satisfactorily is a reason why we should not seek to charge them with others; it is nevertheless our opinion that it is much better to hold to such a simple theory until strong evidence is adduced to render reconsideration necessary.

THE REPRODUCTIVE PROCESS IN BOLETUS SUBTOMENTOSUS.

By W. G. Smith, Esq.

Up to the present time I believe nothing has been published in reference to the reproductive process in Boletus, or even any observations printed on the germination of the spores in this genus. In a mature Boletus nothing is more easy than to see millions of ripe spores; but nothing it would appear is more impossible than to see a single spore in the act of germination. Botanists as a rule have continued to look for the germination of the spores immediately after their fall from the hymenium.

Although there may be no true analogy between a spore and a seed, yet there is sufficient natural similitude to make one remember that whilst some seeds are capable of germination immediately after they reach maturity and will in fact only germinate at that particular period; other seeds require a certain amount of rest before they will start into renewed life. As far as my experience goes the same habit holds good in the fungus tribe—the spores of certain species germinate very readily, whilst others (as those belonging to the genus Boletus) require a rest of from four to six or even eight weeks before they are able to throw out their first new cells. I have only seen the spores of Boletus germinate under one condition, and that condition is attained when the spores have been allowed to rest for at least a month in the wet and putrid remains of the parent fungus from which they originally sprang.

Every field student of fungi must have observed the wet loathsome masses of black treacley putrescence into which Boleti fall in decay. These masses are offensive to the touch, the sight, and the smell; but notwithstanding these confessedly objectionable features, a putrid Boletus will well repay close study.

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When a fragment of a decomposed Boletus is placed under the microscope it will be observed that most of the original constituent cells have vanished, the cells being apparently more or less replaced by myriads of monads, bacteria and vibriones, the special cells of the hymenium, including the basidia and cystidia, being amongst the last to disappear. The intercellular juices will be seen to have given birth to innumerable fine hair-like crystals, whilst the spores will be observed to have suffered no injurious change. Many of the spores will now probably be seen in the act of germination amongst the decomposed cells, the crystals, and the infusoria. Together with typical spores will be seen many other spores perfectly transparent and empty; these are the exospores which have discharged their nuclei. So different do the normal spores and exospores now appear in their different aspects that on a superficial examination only they might possibly be considered as belonging to two series of spores possessing different functions, or even "male and female spores," as recently suggested by Van Tieghem. A large number of spores are from the first effete and have no nuclei, others are barren because they have escaped the spermatic fluid from the cystidia.

The observation of the germinating spores is most conveniently made with a Boletus which has been kept for a month in very wet air under a darkened bell glass.

According to my interpretation of the meaning of the bodies seen upon the hymenial surface of Boletus the reproductive process is exactly the same in Boletus with that described by me under Agaricus and Coprinus. In other words the hymenium is studded over with three forms of cells. The first are more or less globular and barren, the second (named basidia) protrude spicules which carry spores (and these spores may be compared with naked ovules), and the third (named cystidia) are as I conceive essentially male in their functions. The cystidia at length open at their apex and discharge a fluid containing motile granules; these granules on bursting act on the spore as the pollen with its tube does on the ovule or as the spermatozoid acts on the ovum. After fertilization the spores rest for several weeks in the decaying body of the parent; during this period nearly all traces of the spermatozoids are lost, but a considerable change gradually comes over such spores as have been rendered fertile. In Boletus the spores are furnished with from one to four nuclei; these nuclei after fertilization greatly increase in size and translucency; ultimately they get so large as to greatly distort the outer coat of the spore which they at length burst and the nuclei are free. Not unfrequently all the nuclei of one spore become confluent and are discharged as a very large solitary nucleus. These discharged nuclei are not true mycelium but the first round cells of a new fungus, and the increase goes on by increase of cells. In Coprinus the first mycelial threads start from small aggregations of these round fertile cells and no doubt the same law holds good in Boletus. Many observations prove that new Agarics start from aggregations of round cells upon old mycelium, but this does not invalidate the fact that the *first cells* from the spore are not true mycelial threads, but the first round fertile cells of a new plant. To trace these discharged cells to a perfect Boletus of the second generation would be very difficult, and would require continuous observation through an entire year.

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A large number of my observations prove the fact that many fungus spores first germidate on the hymenium of the parent, whether the latter is in a state of decay or not. As for the woody Polyporei, especially those species in which the pores are disposed in strata as in P. fomentarius Fr. P. igniarius Fr. &c. The different strata of pores are simply formed by the spores germinating upon the old hymenium and forming a new series of pores underneath. The glaucous bloom so often seen between and at the mouths of tubes is no other than mycelium and cells from germinated spores. This observation can easily be confirmed.

An unfertilised spore may throw out a thread or even burst and discharge its nucleus, but as far as my experience goes a barren spore of this nature stops with this discharge.

An interest of the first importance attaches itself to the correct interpretation of the meaning of the cystidia; long ago Bulliard, Klotysch, and Corda, described the cystidia as analogous organs with antheridia or pollenidia; the latter author represents Cystidia with open summits ejecting a spermatic liquid; De Bary however can see nothing in cystidia but "cylindrical hairs" because they somewhat resemble "pilose formations" seen upon the pilei of some fungi, the opinions of botanists who differ from De Bary are described by the latter author as "entirely gratuitous." But it is only necessary to examine a few fungi belonging to different genera of the Hymenomycetes to find that De Bary's views are founded upon insufficient observation, the cystidia under Pluteus, Armillaria, and Lactarius are totally different in character from hairs. The very fact of cystidia being crowned with four spicules and springing from the same stratum of cells as the spicule-crowned basidia indicates the probable analogy of function and relationship between the basidia and cystidia. The barren cells of the hymenial surface I consider to be the analogues of the paraphyses amongst the Ascomycetes. As if to show the insufficiency of his observations, De Bary says "it seems" cystidia have not yet been met with in the Hydnei and Clavariei. But if the fruiting surface is examined of a very moderate number of the Hymenomycetes the cystidia will be found exactly alike in size and shape with the basidia, and unless the extra translucency of the former is taken into consideration the fungus really appears to possess no cystidia at all. The common mushroom is a good example of this phenomenon for in this species the cystidia and basidia are so much alike in size, and they pass into each other's form so much that in a young plant it is almost impossible to distinguish basidia from cystidia. It is highly probable that cystidia are present in all the Hymenomycetes but they are often overlooked from their very small size and their similarity in appearance with the barren cells or basidia. Some cystidia are enormous in their comparative size and this is especially the case in Coprinus atramentarius and C. niveus, in these the cystidia are some 200 times the bulk of the basidia.

If it be once granted that cystidia are really sexual organs then it may at once be seen why they are so highly developed in the common and fugitive species. We find them of great size in Coprinus Psathyrella, &c., and in the plants coming under these sections fecundation and germination almost takes place at the same

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time with the complete developement of the parent fungus. Where the fungi are tough and enduring the spores and cystidia are as a rule small, and fecundation and germination proceeds slowly. Seynes in his notes on the structure of the gill plates in Agarics refers to the Cystidia of Coprinus, and says he believes these large projecting organs so common in this genus merely serve the purpose of holding the gills together in infancy, in the same way as the infant pileus is held down to the stem by the annulus. But this view is expressed on insufficient grounds for the cystidia manifestly *keep the gills apart* rather than hold them together. In infancy the cystidia of this genus undoubtedly act as pegs to keep the hymenial surfaces from touching, but they are so loosely attached amongst the cells that they have no power whatever of *holding surfaces together*. In fact all the cystidia I have ever seen are at length pushed bodily out of the hymenium and so set free. This phenomenon is very easily observed in Agaricus Mucidus. The few botanists who combat the idea of cystidia being male in their nature appear to overlook the fact of the open summit of these organs, as figured and described by Corda. Not only has the cystidium an orifice through which its contents are ejected, but I have convinced myself of the presence of a minute operculum in many species. The cystidia in *Lactarius pallidus* are very curious: at first the summit is round and smooth, and the contents are liquid and colorless. Soon however the apex becomes lengthened into a long beak and the contents before liquid are now granular and yellow and move restlessly about within the Cystidium. On reaching perfect maturity, the elongated summit turns aside or gets pushed quite off and the revolving granules rush out.

I have departed a little from the strict consideration of Boletus subtomentosus alone, because I believe that what is true of one species of hymenomycetous fungi is sure to be more or less true of another species, especially when that other species is closely allied to the first, and possibly furnished with organs many times the bulk of the one first under study.

Although Boletus is generally described as being without a trama, yet there is a series of intermediate cells between each tube, and these cells have the long form of ordinary trama cells just as we see similar cells in Paxillus a genus which is commonly charactered as being without a trama. A liquid is exuded from between the cells into the tubes of Boletus which rapidly crystallizes in the form of long straight hair like crystals. The crystals in B. edulis are of a somewhat different form. The basidia are studded over the interior surface of each pore and each basidium bears the normal four spores supported on spicules.

Scattered amongst the basidia are a number of cystidia with mouths at first closed, and at length open, these mouths discharge a fluid containing fine moving granules which I refer without doubt to spermatozoids, these granules attach themselves to the spores and as I believe fecundate them, and after a period of rest the nuclei of the spores become greatly enlarged and burst the outer coat of the spore. When they emerge they are the first cells of a new plant.

In a typical specimen of Boletus subtomentosus five inches in diameter there were 17,100 pores. When highly magnified each single pore (taken to the

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centre of the walls) displayed on its surface no less than 2,097 surface cells. The number of cells exposed on the lower surface of the entire Boletus alone was 35,858,700. The number of spores displayed on the surface alone was 3,898,800. The number of spores in the entire Boletus was 4,678,560,000. The number of cells in the tubes (including spores) 29,487,240,000. The number of cells in the entire fungus 61,344,166,000.

THE GLADIOLUS DISEASE.

For many years past the Gladiolus has been subject to a damaging and singular disease. As in many other diseases of plants, all sorts of conflicting opinions have been expressed regarding the *nature* of the disease—some growers almost denying the existence of any disease whatever, whilst others have described it as so bad as to threaten the almost total extinction of the Gladiolus as a garden plant in this country. As in the case of the murrain of Potatos, Peach blister, &c., different observers have had different conditions of the host plant in view; some writers have attributed the disease to a fungus, whilst others have totally denied the presence of any fungus whatever. Amongst all these conflicting opinions the fact remains that there is a Gladiolus disease, and one singular in its nature, for the cause is at present imperfectly understood.

As far as my experience goes the Gladiolus disease is invariably most virulent in damp, heavy soils, and in wet seasons; in well-drained, dry soils the disease is almost unknown. It is much more destructive in England than in France, simply because the latter country has a clearer and less humid atmosphere. Just as in my experience of the Potato murrain I have found the first attack to be almost invariably made upon the seed tuber whilst in the ground, so I have observed in the Gladiolus the first part attacked is almost invariably the seed-corm which is planted, though the attack may be made *before* as well as *after* planting. When growth commences the diseased condition of the seed-corm rapidly spreads to the sprouting leaves and petioles, and the plant of the year is destroyed. It does not follow as a consequence that the new offsets must be diseased, for the offsets from a diseased corm are frequently quite sound, though it is possible they may have the germs of disease in their constitution, which will only show themselves in a bad form in the spring which follows. It is exactly the same in the Potato disease. Under certain conditions of dryness, diseased seed Potatos will produce healthy plants and tubers free from the murrain. When the corm of the Gladiolus is badly diseased it is shrivelled, and permeated throughout with a rich red-brown colour. When the corms are lifted from a damp soil they are infested with the spawn of different fungi, and as decomposition goes on the corms are at length totally destroyed by diverse fungi, infusoria, nematoid worms and mites.

I have often examined the diseased corms of Gladioli, and made notes of the various parasitic fungi found in and upon them, but till lately nothing has struck me as being specially new or different from what one might expect to find upon decaying bulbs or corms of any variety.

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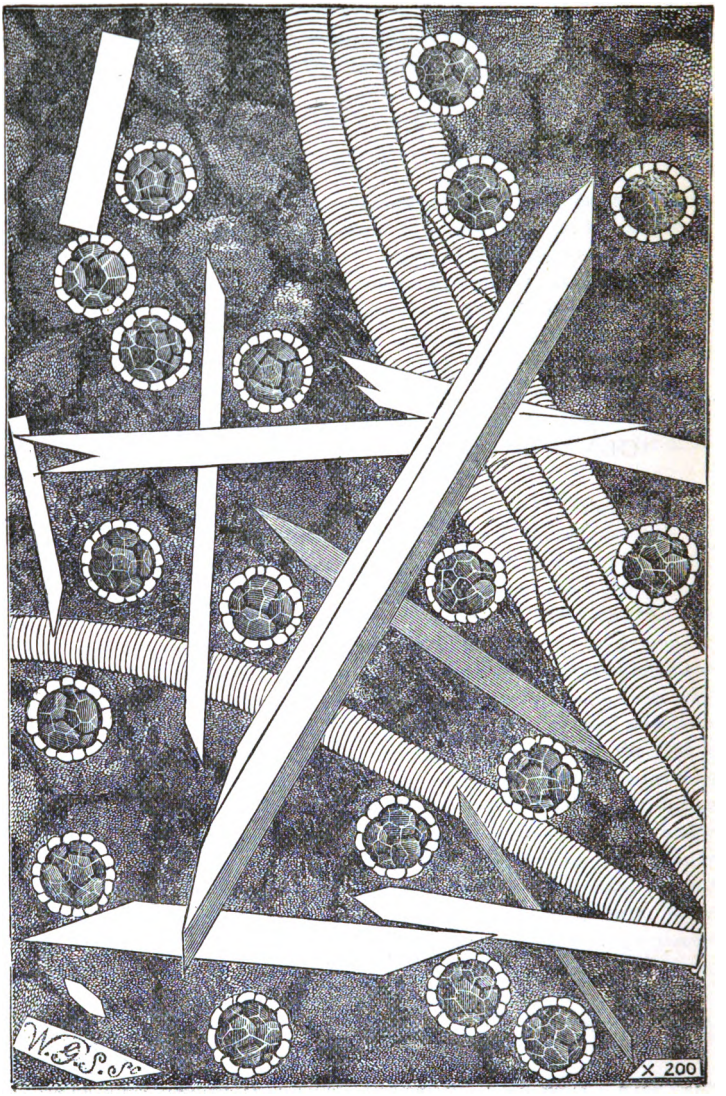
PLATE I.



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GLADIOLUS DISEASE, UROCYSTIS GLADIOLI, W.G.S.

PLATE I.

Fragment of diseased Corm showing the decomposed cells, crystals, and compound fungus spores.

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There is, however, a puzzling and singular *mycelial* growth, commonly found upon diseased Gladiolus corms, which has been pointed to with good reason as the probable cause of the disease. This mycelium is not peculiar to the Gladiolus, for the same pest destroys the bulbs of Crocus sativus, the bulbs of Narcissus, and attacks Potatos, Asparagus, and other plants. It was described long ago by Dr. Montagne, and is known in France under the name of *Tacon*, and in this country as "Copper-web" or Rhizoctonia crocorum, D.C. This "Copper-web" is obviously very imperfectly understood, for at present the fruit is unknown: in fact the very name of Rhizoctonia (like Rhizomorpha) has almost fallen out of use.

In March of the present year the Rev. H. H. Dombrain furnished me with a Gladiolus corm in a very bad state of disease. It presented the usual appearances of the Gladiolus disease as just described, and was a mature seed-corm destined to bloom this year, and not a young offset. On minutely examining this corm under the microscope I found all the cells and starch destroyed, probably from the previous presence of some corrosive mycelium, and the whole interior more or less filled with the bodies here illustrated. Whether these bodies are in any way connected with the threads described under Rhizoctonia there is no evidence to show, for in the first instance we get threads without fruit, and in the new instance now brought forward, fruit without threads, but both the threads and fruit apparently produce the same *effect of disease* upon the corm. Further investigation must clear up this point, but in the meanwhile the bodies detected by me are *undoubtedly new.*

Attention may here be called to the large and magnificent crystals so abundant in Gladiolus corms, and shown in this illustration. Crystals are always formed in cells, but here the great crystals are many times larger than the largest of the decomposed cells of the corm. This phenomenon can only be explained by the probable fact of the crystals aggregating and recrystallising after the cells have been destroyed by the corrosive mycelium.

Different views have been expressed as to the nature of the compound spores found this year in Gladiolus corms by me. At first sight they appear to superficially resemble the resting-spores of a Peronospora, but this view may be at once dismissed. They greatly resemble Papulaspora, but I am convinced by several characters that they do not belong to this genus, or indeed to any mould, but to the order Cœomacei.

These compound spores bear a strong resemblance to the spores of Thecaphora, but I believe they really belong to a new species coming under the genus (closely allied to Thecaphora) named Urocystis. This new species I propose naming Urocystis Gladioli, and it may be characterised as follows:—Sori (or clusters of spores in blisters) obliterated or effused, spores large, compound, consisting of from three to six inner brown cells, and a larger, indefinite number of nearly transparent outer cells, both series of cells being fertile Habitat—On and in the corms and scapes of Gladioli. (See Plate I., enlarged 200 diam, and A, B, Plate II., enlarged 1000 diam.)

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Both the brown and white cells burst, and throw out threads of mycelium. Further observations can alone show whether this mycelium, under certain conditions, may now be capable of existing on diverse hosts as mycelium only, and so put on the characters of Rhizoctonia.

The effused or obliterated sori, or spore blisters, point rather to the genus Thecaphora than Urocystis, but I consider the salient characters belong to the latter genus, and make it the proper one for the reception of the fungus under consideration. Dr. Wittmack, Dr. Magnus, and Dr. Brefeld, of Berlin, have examined my preparations, and they consider the compound spores to belong to Urocystis. As to the peculiar habit and obliteration of the sori, Dr. Brefeld says he has seen Urocystis growing on very different materials, even upon bread. Dr. Brefeld considers Urocystis to be a Sclerotium, or a compact spawn or mycelium in a state of rest, but this is not my view.

Whilst describing this curious fungus it may be well to pass briefly in review its immediate allies as found in this country, with illustrations taken direct from Nature. This will at once show the strong family likeness between the new U. Gladioli and its neighbours. I may say at this point that Urocystis is sometimes described under Polycystis.

The first is Thecaphora hyalina, Fing. (C, D., Plate II.). This species, the only one of its genus, is closely allied in habit with Urocystis Gladioli, for it is without sori; the compound spores are, however, in one series—not two, brown and large, and transparent and small, as in Urocystis. The habit of this Thecaphora is most peculiar, for the fungus grows inside the seeds and seed-capsules of Convolvulus. There is no external evidence on the seed-capsules of the presence of the fungus within.

Urocystis violæ (E, Plate II.) is a common plague of Violets, it causes large gouty swellings upon the petioles and leaves, and otherwise deforms the entire plant. At length the swellings burst, and discharge the innumerable spores.

Urocystis Colchici, Tul. (F, G, Plate II.), a similar plague with the last. It grows upon Colchicum, but is less apparent in its effects.

Urocystis occulta, Preuss (H, Plate II.), a pest found on Rye and various Sedges.

Urocystis pompholygodes, Schlecht. (J, Plate II.)—a disease of the Ranunculaceæ; like U. Violæ it causes great distortion of the host plant, and makes large gouty swellings, which at length burst and discharge an immense number of spores.

Most growers of Gladioli will probably be dissatisfied with this paper and its hard names, but it must be remembered that it is an attempt at a diagnosis of the Gladiolus disease, and treats only of the characteristic and distinguishing symptoms; for, till a disease is understood, a remedy is always out of the question.

Cure is probably quite within reach; but the discussion of this subject must be reserved for another time.—*Worthington G. Smith.*

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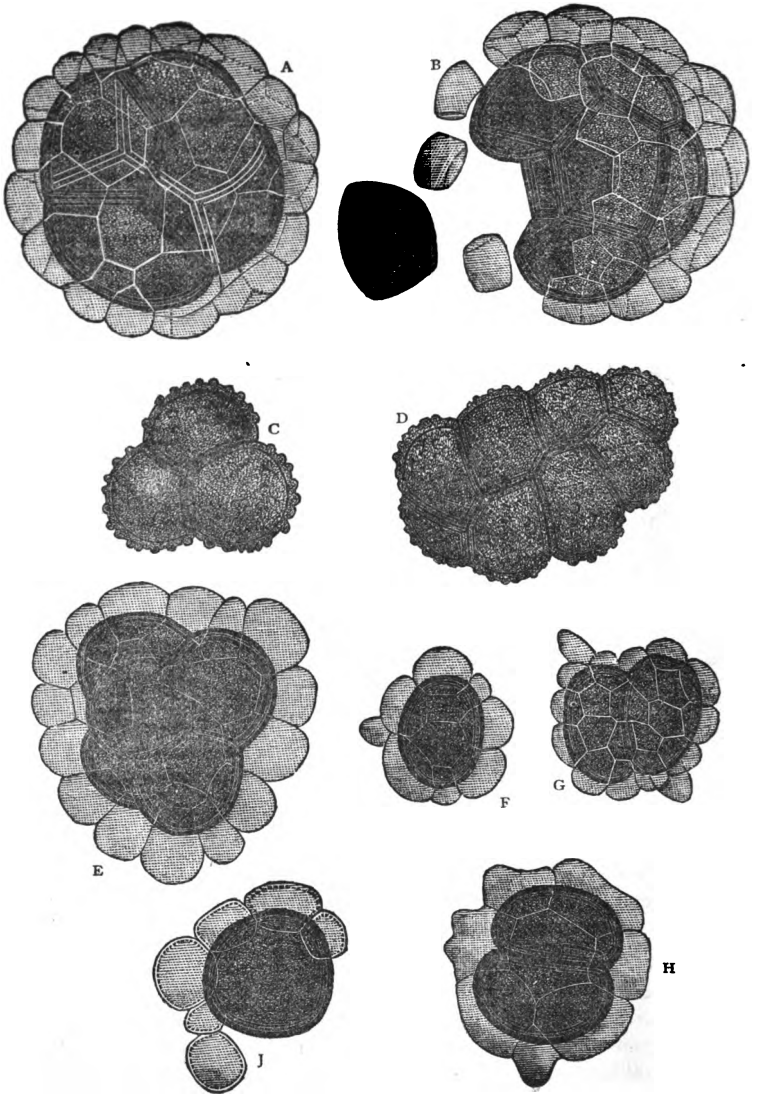
PLATE II.



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GLADIOLUS DISEASE, UROCYSTIS GLADIOLI, W.G.S.

PLATE II.

Compound spores of Urocystis and Thecaphora, enlarged 1000 diameters.

A. Urocystis Gladioli.

B. Urocystis Gladioli in the act of breaking up.

C.D. Thecaphora hyalina.

E. Urocystis violæ.

F.G. Urocystis Colchici.

H. Urocystis occulta.

J. Urocystis pompholygodes.

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Woolhope Naturalists' Field Club.

A NEW HEREFORDSHIRE POMONA.

A special meeting of the members of the Woolhope Naturalists' Field Club was held at the Free Library, Hereford, on Wednesday the 25th ult., to consider the question of publishing a "Herefordshire Pomona." The chair was taken by Dr. Chapman, of Burghill, the President of the Club for the current year; and there were also present Mr. J. Griffith Morris, the President elect; the following vice-presidents; Rev. W. Jones Thomas, Mr. James Rankin, Rev. Charles J. Robinson, and Mr. W. A. Swinbourne; with Rev. C. H. Bulmer, Rev. James Davies, Dr. Bull, Mr. T. Cam, Mr. F. W. Herbert, Mr. G. H. Piper, Mr. J. T. Owen Fowler, and Mr. H. S. Hall, members of the club.

The President said that as Dr. Bull had prepared the whole subject for discussion, perhaps he would at once address the meeting (hear, hear).

Dr. Bull said that they were aware that it had for a long time been the wish of the Woolhope Club to take up the subject of the Pomology of the county, and to make inquiries into the history, varieties, value, and uses of the apples and pears grown in Herefordshire (hear, hear). They had for a long time believed the varieties grown in Herefordshire to be very numerous; and they knew that the whole pomology of the county was neither known nor valued elsewhere as it deserved to be. Three years since, after some conversation on the subject, the Rev. M. J. Berkeley, the celebrated mycologist, sent down as a present to the Woolhope Club large bundles of grafts of all the most valuable apples in the gardens of the Royal Horticultural Society of London. There were no less than 92 sorts of the best recognised eating and cooking apples, "pot fruit," as the term goes here, in contra-distinction to "cider fruit." The club gave grafts of each kind to Messrs. Cranston and Mayos, and distributed the others among their own members. On the following year an exhibition of apples, of a very interesting description, took place in connection with the club's autumn meeting; and in the present year there was another exhibition of apples, which had excited even more interest than the show of last year (hear, hear). The Club, following its usual plan, endeavoured to obtain the services of the best and most experienced man they could find to look at those apples, and, through the influence of the Rev. Mr. Bulmer, of Credenhill, who saw Dr. Hogg at the Bath and West of England Show, that gentleman promised to come to Hereford to inspect the Club's exhibition of apples and pears. Dr. Hogg, as the head of the Royal Horticultural Society's gardens in London and Chiswick, as the author of the best *Fruit Manual*, and editor of the *Journal of Horticulture*, is the first Pomologist in the country. Dr. Hogg came to Hereford, and was fairly astonished to see at once so many

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kinds of apple that were new to him. Many were sent to be named, and he could not name them, for they had no names (hear, hear). Many of them were valuable apples, so quite distinct in character, and with such excellent qualities that they deserved to be better known (hear, hear). Dr. Hogg suggested that a local Pomona should be compiled, and he himself promised, if the Club desired it, to give them the benefit of his experience and knowledge on the subject. He also offered, if the Club thought proper to call upon him to do so, to edit the Pomona himself (hear, hear). That revived the old idea which had been entertained by the Club. It was now many years since Knight's "Pomona Herefordiensis" was published, and that work had become so scarce and valuable that a copy could seldom be procured. The expensive way in which that book had been brought out made it a very difficult one to follow. The Club felt a greater difficulty still, and that was the want of a real knowledge of all the recognised 'apples, so that they might at once recognise what was new, and what was known elsewhere—so that our apples might be valued at the proper estimate. That difficulty, he believed, could now be overcome, inasmuch as they had the promise of Dr. Hogg to edit the publication (hear, hear). The Club, also, was particularly fortunate in having the Rev. Henry Bulmer, of Credenhill, as one of its members: He (Mr. Bulmer) was a noted pomologist himself, and had taken great pains to promote the study of pomology, and in bringing Dr. Hogg down to Herefordshire; he had also kindly undertaken to work with Dr. Hogg, and take the lead in making inquiries in the different districts of the county (hear, hear). The Club would also require the cordial co-operation of the chief growers of fruit in Herefordshire, to obtain a proper account of the fruit which they grew. It would really be of value to Herefordshire to make known the description of fruit grown in the county, and the advantages which the county possessed for growing it. The orchards would become of much more value if the different kinds of fruit grown in them were carefully studied and properly known (hear, hear). Herefordshire had the very best soil for growing apples, and with the present rapid means of communication, Herefordshire—considering its soil—ought to be the orchard of England (hear, hear). This rendered it the more important, also that they should grow the very best kinds of apples, for "pot fruit" would pay better than "cider fruit" in these days (hear, hear). They might, therefore, he believed, depend upon having the assistance of the growers in the work which the Club proposed to undertake. They had seen the trouble they took to send apples to the annual exhibition of the Club. The Club exhibited not for prizes, but simply to show the different kind of apples that were grown in the county. The growers would, he believed, help the Club to make the inquiries which they wished to make, in every way they could. The time had therefore arrived, he (Dr. Bull) thought, when they might attempt the publication of a "Herefordshire Pomona"—with the scientific and practical knowledge of Dr. Hogg, and his hearty good-will, at the head of the movement; with the energy, perseverance, and knowledge of Pomology possessed by Mr. Bulmer to work up the required information; with the growers of fruit ready to impart this information—and with the machinery of the Woolhope Club they ought to be able to

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carry on the work satisfactorily, always supposing that it would be well supported by annual subscriptions from the public. The Club ought carefully to consider the subject. He had prepared a resolution which he hoped might be acceptable; and as that would explain his ideas more fully he would, without further remarks, read it. He would suggest:—

"That a Pomological Committee, consisting of members of the Woolhope Club, in conjunction with the growers of fruit, be formed to investigate the varieties of apples and pears grown in the district; to inquire into their origin and history; to ascertain their value and uses; and to name such varieties as are not known elsewhere, and have a really distinct character, with a view to the publication of a "Herefordshire Pomona"; and that Dr. Hogg, F.L.S., be requested to edit the work. It is proposed that 'The Herefordshire Pomona' should be published in annual parts, quarto size, to correspond with Knight's 'Pomona Herefordiensis.' That the first part should be issued at the close of next year, 1877, and that it should consist of three or more coloured plates, with descriptive letterpress, according to the amount of annual subscriptions received. That the expenditure of the committee be kept entirely distinct from the ordinary funds of the Woolhope Club, and that a separate subscription list be opened for defraying the expenses of publication. That the price of the parts separately be 10s. 6d. each; to annual subscribers 7s. 6d.; and to annual subscribers who are members of the Club 5s. each part. The names of all subscribers to the work must be given to the hon. secretary before the last Club meeting of the year, and the subscription must also be paid before that time."

The particular form that the publication should take had been discussed among themselves, and it was agreed that although "The Herefordshire Pomona" should be an entirely separate and distinct work from the "Pomona Herefordiensis," it would have the same objects in view, and be of the same size, and in that sense would be a continuation of Mr. Knight's work. If the illustrations were always to represent the exact size of the apples, he questioned whether a reprcsentation of the *Gloria Mundi* could be got on any page less than a quarto (laughter). In Mr. Knight's "Pomona" the illustrations were beautifully done, brought out with copperplates; but the plates in the proposed publication would be chromolithographs. The illustrations would doubtless appear a little more flashy in colour than if they were hand-painted; but he trusted they would be true to nature, which was the great object to attain (hear, hear). Dr. Bull had seen a good wood engraving of Mr. Knight himself: and he thought it would appear exceedingly gracious on their part to publish a likeness of Mr. Andrew Knight with the first part (hear, hear). In order to carry out these suggestions the Club would require the services of an active secretary, and he was happy to say they could obtain such assistance from Mr. Reginald Symonds, who was very willing to take up the subject, and to study the pomology of his native county. He would have plenty of work to do, for the real practical success depended very much upon the honorary secretary; but he was ready to do it because he believed it would be of great service to the county (hear, hear). With regard to the expense of the publication, that, of course, depended upon the number of parts published and

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upon the amount of subscriptions. The approximate cost of the work, with three coloured plates representing the size of the apples, would be £35 or £40 a year. He believed a small subscription would produce that sum annually; but if they could get £60 a year subscribed the publication might then be illustrated with six coloured plates. He thought it better to adopt this plan, and let the work stand on its own merits, than to depend upon patronage and a comparatively few large subscriptions. They only meant to spend each year the money subscribed, and it would all be spent in the publication alone, so that the more subscriptions they got the more the subscribers individually would get for their money (hear, hear).

Rev. Jones Thomas said that Dr. Bull had said nothing with reference to giving his own assistance in conjunction with Dr. Hogg and Mr. Bulmer in the proposed undertaking.

Dr. Bull said that he would render all the assistance he could (hear, hear).

Rev. Jones Thomas asked whether the publication would, if issued, be limited to Herefordshire only? In the little county of Breconshire there was red sand, and he did not want to praise what could be grown there.

Dr. Bull said that as soon as they had exhausted the subject in Herefordshire they might perhaps go into Breconshire (hear, hear).

Rev. Jones Thomas remarked that a more popular subject than "Pomona" could not possibly be suggested for the benefit of Herefordshire (hear, hear). Subscriptions, he believed, would readily be obtained from all parts of the county. Of that he was not in the least afraid. He only hoped that the publication, as suggested by Dr. Bull, would be started, and that it would be a very great success (hear, hear).

Rev. C. J. Robinson asked whether it was intended to reproduce all that had appeared in "Knight's Pomona?"

Dr. Bull replied that at present they had better confine the publication to apples that were growing in the county and to the new kinds. They had better at first keep to the special Herefordshire kinds.

Rev. C. J. Robinson said that if the new publication should be considered complete without the contents of "Knight's Pomona" it would not be quite so acceptable to those who, like himself, did not possess a copy of Knight's work.

Mr. Fowler apprehended that the new work would be entirely distinct, and reminded the club that the copyright of Knight's work belonged to the Agricultural Society of the county, and, therefore, they could not use any of the contents of that work in the new publication without the consent of that society.

Dr. Bull said that there was so much new work in the county to be done that they had better leave the reproduction of Mr. Knight's work till a future time. It had been proposed that a separate guarantee fund should be raised to the amount of £50 in case the subscriptions should fall short. He did not believe that the subscriptions would be less than the sum required; but it would be safer to have a separate guarantee fund for each year. The Club had guaranteed £20;

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he himself £5; Rev. C. H. Bulmer, £5; and Mr. Rankin, £5; Rev. James Davies, Moor Court, £5; George H. Piper, Esq., Ledbury, £5; and the Rev. William Jones Thomas, Llan Thomas, £5 for the year 1877. Of course if the guarantors were called upon in any single year there would soon be an end of the publication.

Mr. J. G. Morris said that he should not have ventured to move the first resolution (as read by Dr. Bull)) had it not been that the Club had kindly placed him in the president's chair for the ensuing year; and as the resolution would doubtless receive prominent attention during his year of office, he had less hesitation in proposing it than he should otherwise have had. Some few years ago the Bishop of Manchester when addressing a public meeting in the Shirehall, rather startled some of his hearers by saying that Herefordshire was peculiarly different from other counties in England, in having many harvests; and he made out that in Herefordshire there were no less than seven harvests. They began with wool, and continued with bark, hay, corn, hops, potatoes, and last—the one most special to the county—the vintage harvest—that was as much as to say, the apple and pear crops. The soil and climate of the county were adapted to the growth of the apple. No doubt a feeling of that sort prompted the late Mr. Knight to commence his "Pomona," and it had been pretty nearly decided to-day to have a pomological department established under the auspices of that Club. He had very little doubt as to the success of the publication, which would enhance the study of pomology; and anybody who wished to obtain knowledge of the growth of apples and pears in the county should have a book of the kind suggested to refer to (hear, hear). If any persons prepared such a work, who were better able to set about it than the Natural History Club resident on the spot? (hear, hear). He had great pleasure in proposing that a pomological department be formed in connection with the club (hear, hear).

Mr. Rankin seconded the proposition, and suggested that a small handbook of the pomology of the county should be published simultaneously with the more expensive work, so as to bring the study of the subject within the reach of all classes.

Dr. Bull said that the suggestion was a very practical one, but he thought, in the present state of knowledge on the subject, it could hardly be expected that they should issue a small handbook simultaneously with the more expensive work until they had gained sufficient information to compile one. That would be a work of some four or five years at least.

The proposition was carried unanimously.

On the motion of Dr. Bull, seconded by the Rev. J. Davies, the following gentlemen were appointed the general committee, viz., the President of the Woolhope Club, chairman; Sir Henry Scudamore Stanhope, Bart., Mr. W. H. Apperley (Withington), Dr. Bull, Rev. C. H. Bulmer, Mr. H. C. Beddoe (Hereford), Mr. John Bosley (Lyde), Mr. Thomas Cam, Dr. Chapman (Burghill), Mr. Joseph Carless, jun., Mr. John Cranston (Kings Acre), Dr. M'Cullough, Rev. James Davies (Moor Court), Mr. J. T. Owen Fowler, Mr. Hall (Garford), Mr. F.

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H. Herbert, Mr. William Hill (Eggleton), Mr. W. Jay (Lyde), Mr. Thos. Mason (Wellington), Mr. George H. Piper (Norton Canon), Mr. Pitt (Bosbury), Rev. J. C. Robinson, Mr. James Rankin (Bryngwyn), Mr. W. A. Swinbourne (Cusop), Mr. Charles Watkins, Mr. Arthur Thompson, with power to add to their number.

Rev. Jones Thomas proposed, and Mr. Swinbourne seconded, that the sub-committee consist of the Rev. C. H. Bulmer (chairman), Mr. H. C. Beddoe, Dr. Bull, Mr. Thomas Cam, Dr. Hogg, F.L.S. (London), and Mr. Fowler, Mr. J. Griffith Morris with Mr. Reginald Symonds, hon. sec.—Carried unanimously.

Dr. Bull proposed that Mr. Reginald Symonds be appointed treasurer and secretary for this special work.

Mr. Fowler seconded the proposition, and it was agreed to unanimously.

At this period of the meeting, Mr. John Bosley, Mr. Mason (Wellington), Mr. W. Jay, Mr. Thomas Pitt (Bosbury), Mr. Wm. Hill (Eggleton), and Mr. H. C. Beddoe, and Mr. Cale (Tarrington) entered the room, and

Dr. Bull repeated the object of the meeting to them, and stated that the Club had decided to make the attempt to publish a "Herefordshire Pomona" if the project met with the support of the growers.

Mr. Bosley said he approved very highly of the step that had been taken by the club, and he thought that growers generally would hail the movement with approbation.

Mr. Jay also spoke approvingly of the object of the meeting.

Mr. William Hill said he should be happy to support the Club in their present efforts, and would endeavour to gain for them the approval of his neighbours (hear, hear). The movement, he was sure, would become very popular.

The discussion now became general, Mr. Piper, from Ledbury, had brought some very interesting seedling apples raised by himself; and Mr. Bosley had also brought the fruit of a seedling which promised well in its fruit.

Mr. Piper remarked that the *Golden Pippin* possessed no less than 16 different names in England. That was a strong argument as to the want of a publication like that referred to by Dr. Bull (hear, hear). He was quite convinced, from experience, that apples would frequently come true to seed. He had proved it himself several times, and had found the young plants bear fruit with the characters of the parents, though not always so strongly marked. Mr. Piper exhibited apples from his seedlings in proof of his remarks, which were thereupon tasted and discussed.

This concluded the business of the meeting.

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Woolhope Naturalists' Field Club.

The general annual meeting of the members of the Woolhope Naturalists' Field Club was held in the club room at the Free Library, Hereford, on Tuesday, February 13th, Present—Dr. Chapman, President (in the chair), J. Griffiths Morris, Esq., the President elect; the Rev. William Jones Thomas, James Rankin, Esq., and W. A. Swinburne, Esq., Vice-Presidents; the Rev. James Davies, Vice-President elect; F. Bodenham, Esq., Dr. Bull, Rev. J. F. Crouch, T. Curley, Esq., James Davies, Esq., Theos. Lane, Esq., Rev. F. T. Havergal, John Lloyd, Esq., Rev. H. Cooper Key, Joseph Greaves, Esq., Rev. F. Merewether, Rev. G. M. Metcalfe, and Mr. Arthur Thompson, secretary.

The Treasurer presented a statement of his accounts for the year 1876, duly audited.

Dr. Chapman presented the meteorological report for 1876; and Messrs. Stephens and Thompson presented the register of the flood waters on the Wye for 1876.

The following times and places were fixed for the field meetings for 1877:—

1. On Thursday, May 17th, Mordiford.
2. On Tuesday, June 19th, Midsummer Hill, Eastnor.
3. On Thursday, July 19th, Presteigne (Ladies' day).
4. On Tuesday, August 21st, Trelleck, near Monmouth.
5. On Tuesday, October 4th, Fungus Foray.

Rev. C. H. Bulmer, Credenhill, was re-elected a member; Rev. Wm. Bowell, Chandos House, Hereford, was elected a member.

On the completion of the above business the members adjourned to the Green Dragon Hotel to dinner, when the following additional members joined them:—Thomas Blashill, Esq. (London), Rev. C. H. Bulmer (Credenhill), E. Colt Williams, Esq. (Hereford).

After dinner, Dr. Bull reported how they were getting on with the Herefordshire Pomona.

Dr. Chapman read his retiring address as President. A vote of thanks was unanimously carried to the retiring President for the way in which he had fulfilled the office during the last year, and for his admirable address.

The Rev. C. H. Balmer read a paper on "Pomology Historically Considered."

James Davies, Esq., read a paper on "Shrove-Tuesday and its customs."

E. Colt Wiiliams, Esq., alluded to the annual custom at Westminster School on Pancake day.

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THE WYE.

Register of height of River in the year 1876, taken at Hereford at 9 a.m.
The datum point is the Summer level of the River.

1876.	No. of days wet or stormy.	No. of days dry.	Height of River above summer level.		Average height each day.		No. of days of Low Water.	OBSERVATIONS.			
			Ft.	Ins	Ft.	Ins.			Ft.	Ins.	
January	9	22	61	9	1	11 7/8	0	Height of river on 25th	6	,,	
February.....	14	15	113	4	3	10 1/4	0	,, ,, on 16th	11	,,	
							0	,, ,, on 17th	11	,,	
March	22	9	102	6	3	3 5/8	0	,, ,, on 6th	9	,,	
April.....	18	12	41	1	1	3 3/8	0	,, ,, on 11th	8	,,	
May	4	27	3	5	0	2	27				
June	0	30	,,	,,	0	0	30				
July	0	31	,,	,,	0	0	31				
August.....	8	23	42	3	1	4 1/8	7	,, ,, on 3rd 4th & 5th	5	,,	
Septemebr	13	17	78	3	2	7 1/4	0	,, ,, on 1st	7	8	
October	12	19	105	4	3	4 1/2	0	,, ,, on 9th	13	6	
November	14	16	51	8	1	8 3/8	0	,, ,, on 27th	9	6	
December	26	5	164	1	5	3 1/4	0	,, ,, on 28th	13	6	
Total	140	226	763	8	21		95		94	2	Average 9 ft. 5 in. each day.

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METEOROLOGICAL REPORT FOR 1876, TAKEN AT BURGHILL, HEREFORD, 279FT. ABOVE SEA LEVEL,

By T. A. Chapman, M.D.

The Meteorological Society has recently organised a system of regular observations, and has obtained the assistance of about a score of observers who take observations at 9 a.m. and 9 p.m. daily. These are the most complete observations taken except those at a few first-class observatories. Having commenced to take observations last year I agreed to take them according to the above system. The advantages of these observations is their systematic character, being taken at all stations at the same time. The great defect of previous observations, which has seriously retarded meteorological science, was the desultory character of the observations, each observer chosing his own time for observations and his own items for record, so that no comparison was possible and no picture of the atmospheric condition over the whole country at once obtainable.

I add in tables as an appendix to this report an abstract of my observations for 1876.

The chief features of the year were the somewhat excessive rainfall, and its remarkable distribution, the excess having occurred in the last few months, the first seven months having indeed been deficient; and the unusually high temperature attained during two periods in July and August. With regard to these, it is to be observed that the highest temperature I recorded was 89·5° in the shade, whereas others recorded temperatures 6° or 7° higher. There can be no question that the mass of the records of very high temperature in the shade are untrustworthy. The whole matter depends on the method of exposure of the thermometers. The temperature of the air is what we desire to ascertain, apart from the effects of radiation or evaporation. My thermometers are exposed in the manner advised, after careful consideration, by the Meteorological Society, and I think must make a very close approximation to the result desired. The temperature in the sun recorded at the same time was 141°, and it is obvious that any defect in the method of exposure of the thermometer will according to its extent more or less approximate the temperature in the so-called shade to this higher degree. Not only will any defect in the thermometer stand lead to error of this nature, but so also will the proximity of walls, buildings, roads, gravel paths, &c. Even when their direct radiation is excluded, they will produce currents of air hotter than the true atmospheric temperature.

The mean height of the barometer for the year was 29·889 in., about ·060 below the average for England. The readings for January were very high, exceeding 30 in. on all but two days, and averaging 30·280, associated with a mean temperature slightly above the average, and no marked defect of rainfall. In May the barometer had again a very high average, viz., 30·172 in., associated with a predominance of winds ranging round from E. by N. to N.W., and an almost entire absence of S. and S.W. The rainfall was very meagre, viz., 0·29 in., and

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the mean temperature deficient. The lowest readings were in December, when the average was only 29·426 in., associated with an excessive rainfall, 6·056 in., and a high temperature, viz., 43·0°, and a prevalance of S. and S.W. winds. A very deep and not wide depression passed over on the 3rd and 4th December, its apex passing Hereford at 8 a.m. on the 4th, the lowest reading at Burghill being 28·241 at 8 a.m. A series of observations during the depressions showed its sides to be very similar in their steep regular slopes, the apex being rounded. The mean reading of the barometer in March was also very low, viz., 29·587 in., associated with S.W., W., and N.W. winds and a low temperature.

The mean temperature for the year was 49·2°, about an average; high in January, February, and December; low in March and November. The extreme temperatures of a few days in July and August did not unduly raise the average. The highest readings were—

July—13	82·3°	August—12	81·9°
14	86·9°	13	89·5°
15	89·3°	14	86·2°
16	88·9°	15	81·9°
21	82·0°	16	84·3°
22	84·5°	17	85·8°
23	81·1°		
25	80·7°		

There were no intense frosts during the year. On two days only, the 8th and 9th January, the thermometer failed to rise above 32° during some portion of the day (in the shade). It fell below 32° in the shade on 44 days, and below 32° on the grass on 111 days.

The rainfall was a few inches in excess of the probable average for the station, having amounted to 31·58 inches. It was defective in May, June, and July, the amounts being 0·29, 1·16, and 0·801 respectively; in great excess in September, November, and December, viz., 5·089, 4·105, and 6·056 inches.

There were no extremely heavy falls, no fall amounting to one inch was recorded during the year, the nearest approach being ·99 on January 20 and ·97 on September 30. Even during December the excessive fall was fairly distributed; the heaviest fall being 1·60 in. during the last three days of the year. The continuousness of the fall was its most remarkable feature. Only one dry day was recorded between September 22nd and October 20th inclusive, viz., 28 days. From November 11th to December 7th inclusive, viz., 27 days, only two dry days are recorded; and from December 26, 1876, to January 19th, 1877, only one dry day appears, and if falls of less than ·01 be noticed we may go on to February 7th with only three dry days.

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BAROMETER READINGS FOR 1876, CORRECTED AND REDUCED TO 32° AT MEAN SEA LEVEL TAKEN AT BURGHILL, HEREFORD.

	Mean of 9 a.m. Readings	Mean of 9 p.m. Readings	Mean of daily Readings	Highest during month.	Date.	Lowest during month.	Date.	Monthly Ranges.	Mean Daily Range.	Greatest Daily Range		Least Daily Range.	
January	30·282	30·277	30·280	30·694	15th	29·675	20th	1·019	·155	·572	21st	·025	23rd
February	29·789	29·785	29·787	30·287	2nd	29·106	18th	1·181	·168	·407	24th	·033	12th
March	29·571	29·584	29.587	30·181	19th	28·636	9th	1·545	·278	·842	9th	·032	31st
April	29·859	29.868	29.864	30·501	5th	28·874	19th	1·627	·253	·559	17th	·027	29th
May	30·173	30·171	30·172	30·485	4th	29·655	22nd	·830	·110	·336	21st	·017	28th
June	29·994	29·993	29·993	30·253	1st	29·710	3rd	·543	·130	·470	10th	·016	17th
July	30·090	30·092	30·091	30·485	12th	29·620	31st	·865	·142	·445	27th	·039	13th
August...	29·939	29·942	29·941	30·348	11th	29·076	31st	1·272	·165	·617	30th	·014	21st
September	29·794	29·786	29·790	30·379	30th	29·328	30th	1·051	·159	·322	3rd	·016	13th
October	29·873	29·924	29·898	30·331	31st	29·028	11th	1·303	·145	·496	8th	·005	25th
November	29·862	29·847	29·854	30·397	1st	29·189	12th	1·208	·195	·676	11th	·036	1st
December	29·424	29·429	29·426	30·188	9th	28·241	4th	1·947	·274	·598	4th	·027	15th
The Year	29·887	29·890	29·889	30·694	Jan.	28·241	Dec.	2·453	·158	·842	Mar.	·005	Oct.

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TEMPERATURE IN THE SHADE 1876,
CORRECTED.

	January.		February		March		April		May		June		July		August		September		October		November		December		Year.	
Maximum Thermometer—	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.	°	Date.
Highest Reading ...	54·8	4th	57·3	28th	57·9	3rd	63·8	7th	68·1	21st	81·9	21st	89·3	15th	89·5	13th	70·2	21st	67·4	6th	58·9	15th	56·2	28th	89·3	July
Lowest ,, ...	29·8	9th	32·6	13th	36·7	19th	39·9	13th	48·8	2nd	56·2	15th	62·7	11th	57	31st	52·6	30th	47·0	23rd	36·0	9th	32·9	23rd	29·8	Jan.
Times below 32° ...	2																								2	
Mean Reading ...	43·3		46·5		46·8		54·9		58·9		67·7		75·0		71·9		62·1		57·2		48·1		47·2		59·9	
Minimum Thermometer—																										
Highest Reading ..	44·2	31st	47·	18th	42·8	3rd	49·8	6th	52·0	27th	57·3	20th	60·1	17th	61·1	18th	53·8	6th	58·0	6th	47·4	16th	47·4	31st	61·1	Aug.
Lowest ,, ...	23·0	2nd	19·8	12th	19·4	19th	29·3	12th	29·9	3rd	34·7	1st	44·1	12th	39·4	31st	40·1	15th	35·0	26th	26·0	11th	21·6	24th	19·4	Mar.
Mean ,, ...	33·0		36·2		34·0		39·4		39·7		47·5		53·9		51·2		48·7		47·0		37·7		36·6		42·1	
Days below 32° ...	12		6		10		5		1		—		—		—		—				6		4		44	
Monthly Range ...	31·8		37·5		38·5		34·5		38·2		47·2		45·2		50·1		30·1		32·4		32·9		34·6		69·9	
Greatest daily Range ...	22·6	2nd	23·9	14th	19·9	25th	27·5	3rd	29·8	4th	34·1	1st	33·8	13th	36·6	11th	25·1	21st	18·0	12th	24·7	2nd	23·9	27th	36·6	Aug.
Least ,, ,, ..	2·6	14th	2·2	7th	5·8	26th	7·9	13th	9·8	27th	6·4	15th	9·8	11th	9·9	29th	4·1	5th	3·1	23rd	3·3	13th	3·0	18th	2·2	Feb.
Mean ,, ,, ...	10·5		10·3		12·8		15·4		19·1		20·1		21·2		20·6		13·8		10·5		11·1		8·4		14·5	
Mean of 9 a.m. Readings	36·5		40·4		40·7		47·6		50·9		59·9		65·4		61·7		55·6		51·7		42·8		42·8		49·6	
Ditto 9 p.m. ,,	37·2		39·2		38·7		44·6		47·8		55·9		62·3		60·2		53·0		50·2		42·1		43·1		47·9	
Ditto Temperature	38·1		42·3		40·4		47·2		49·3		57·6		64·4		60·5		55·4		50·1		42·9		43·0		49·2	
Ditto Dewpoint ...	34·4		36·8		35·0		40·4		40·3		48·2		53·6		52·7		49·6		47·4		39·2		40·2		43·2	
Ditto Humidity 100...	86		80		80		79		71		70		63		73		80		92		86		90		79	

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TEMPERATURE IN THE OPEN 1876.

Observations Corrected.

	January		February		March		April		May		June		July		August		September		October		November		December		Year.	
Black Bulb in Vacuo Maximum Readings.		Dte		Dte		Dte		Dte		Dte		Dte		Dte		Dte		Dte		Dte		Dte		Dte		Date.
Highest Reading ...	94·9	18th	105·1	27th	115·3	30th	124·0	7th	129·5	28th	135·3	21st	141·0	19th	138·4	8th	130·8	2nd	118·0	5th	102·1	2nd	91·0	6th	141·0	July
Lowest ,, ...	36·8	21st	44·1	7th	58·3	8th	63·9	30th	87·1	26th	103	15th	116·3	5th	100·7	31st	58·5	30th	54·6	28th	41·4	12th	34·2	26th	34·2	Dec.
Mean ,. ...	50·3		77·3		92·3		107·5		117·4		125·4		130		124·5		108·6		90·6		73·6		63·6		96·8	
Range ,, ...	58·1		61·0		57·		60·1		42·4		22·3		24·7		37·7		72·3		63·4		60·7		56·8		106·8	
Grass Minimum—																										
Highest Reading...	41·6	31st	47·	18th	40·1	8th	45·2	6th	43·9	27th	54·3	21st	58·7	7th	61·8	18th	53·0	23rd	55·5	9th	46·7	6th	47·1	3rd	61·8	Aug.
Lowest ,, ...	11·8	12th	13·4	12th	12·9	19th	17·6	16th	18·8	3rd	30·8	11th	39·2	12th	33·3	25th	37·0	15th	31·7	26th	20·9	8th	17·6	24th	11·8	Jan.
Mean ,, ...	29·2		36·2		27·7		31·6		31·2		44·1		50·4		49		45·8		43·4		33·8		35·5		38·1	
Range ,, ...	29·8		33·6		27·2		27·6		25·1		23·5		19·5		28·5		16·0		23·8		25·8		29·5		23·7	
No. of days below 32°	18		16		22		14		17		1		—		—		—		1		12		10		111	

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RAIN, WIND, CLOUD, &c, 1876.

	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December.	Year.
Rain Amount ...	1·78	2·36	2·73	2·47	0·29	1·16	0·801	2·37	5·089	2·372	4·105	6·056	31·58
Days on which ·01 or fell	7	21	21	17	6	9	7	18	21	18	19	21	185
Greatest Amount on any one day ...	·99	·31	·45	·63	·12	·37	·23	·55	·97	·56	·75	·85	·99
Date	20	20	30	29	23	9	6	8	30	8	12	31	Jan.
Wind Average estimated force.													
9 a.m. ...	1·2	1·9	2·5	1·5	1·5	1	—	·8	·8	·8	·75	1	
9 p.m. ...	1·2	2	2	1·2	·8	·6	—	·8	·75	·8	·7	1·3	
Amount of Cloud 1-10 9 a.m.	...	7	7	6·3	6	5·4	—	8	6·1	8	6	8·7	7·3
Amount of Cloud 1-10 9 p.m.	...	6	6·5	5·2	3·5	5·0	—	7	5·7	7	6	7·0	5·7

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DIRECTION OF THE WIND, 1876. DAYS IN EACH QUARTER AT 9 A.M. AND 9 P.M.

	January.		Feb.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		Dec.		Year.	
DIRECTION—	9 a.m.	9 p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
N.	2	5	2	3	3	1	2	4	0	2	1	1	0	0	2	1	1	2	0	0	1	2	0	0	14	21
N.N.W.	0	0	1	0	0	2	1	0	1	1	1	1	0	0	2	2	2	0	0	1	3	2	2	1	13	10
N.W.	1	0	3	3	2	4	1	2	2	0	1	1	0	0	2	2	4	3	1	1	2	3	2	0	21	19
W.N.W.	1	1	1	0	5	3	2	1	1	3	1	1	2	3	2	3	2	1	1	0	3	2	2	3	23	21
W.	2	2	4	4	4	4	2	1	3	4	3	3	3	3	5	3	4	5	1	0	1	2	2	1	34	32
W.S.W.	0	0	3	4	2	4	1	1	0	0	5	2	3	6	4	2	2	1	0	0	1	1	0	2	21	23
S.W.	2	2	5	3	5	1	1	2	1	0	1	1	3	0	1	3	1	0	1	3	2	0	3	4	26	19
S.S.W.	2	3	1	2	1	1	2	0	0	0	1	1	1	0	2	2	1	3	6	1	0	1	1	2	18	16
S.	2	2	1	1	1	1	5	6	1	0	3	3	2	2	0	1	1	3	2	4	3	3	5	3	26	29
S.S.E.	2	1	1	0	1	1	1	2	0	0	0	0	0	0	0	0	1	0	1	3	2	3	2	3	11	13
S.E.	5	1	0	1	1	2	2	0	0	0	0	1	0	0	1	1	1	1	2	2	3	4	3.	3	18	16
E.S.E.	3	3	1	1	0	1	0	1	0	1	2	1	0	0	2	0	3	2	4	1	0	2	2	3	17	16
E.	2	1	0	0	4	4	5	3	5	2	1	0	0	0	3	3	3	3	1	3	2	1	3	2	29	22
E.N.E.	3	2	1	1	0	0	0	0	7	6	2	3	0	0	0	1	1	1	4	4	1	2	0	0	19	20
N.E.	1	3	1	2	2	1	1	3	3	7	1	2	0	0	1	1	0	0	1	2	2	0	1	4	14	25
E.N.E.	3	1	3	4	0	0	3	1	3	4	3	3	0	0	0	1	1	2	0	0	1	1	0	0	17	17
Calm.	0	3	1	0	0	1	1	3	4	1	4	6	1	0	4	5	2	3	6	6	3	1	3	0	29	29
Not Recorded.	0	1	0	0	0	0	0	0	0	0	0	0	16	17	0	0	0	0	0	0	0	0	0	0	16	18

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ADDRESS OF THE RETIRING PRESIDENT, T. ALGERNON CHAPMAN, ESQ., M.D.

Gentlemen,—The present meeting brings to a close the year during which you have done me the honour of placing me in your Presidential chair, and, by the rules of our Club, it is necessary that I should address you on the proceedings of the Club during my term of office. The rule is, I think, a useful one, although it presses with undue weight on one who has no striking events to chronicle and is lacking in the literary ability to make his escape, like the cuttle, behind a cloud of ink; I fear you will add that a fair share of the penalty is also paid by those who have to listen to the address.

Although the past year has been uneventful, and although our field meetings have not had all the brilliance of some that I can remember in former years, and especially although they have been more than usually lacking in any real work in the field, our proceedings have not been altogether a blank. Our meetings served their most important purpose of bringing us together, and stimulating such scientific ardour as some of us found ourselves possessed of. And we have had a few good papers to add to our transactions. The fungus meeting was marked by the visit of an unusual wealth of distinguished mycological savants, and, despite the weather, some real work was done and some valuable papers were communicated. On the same occasion the pomological section of the club, so recently established, gave remarkable evidence of vitality, and promises under the powerful Ægis of Dr. Bull to produce valuable results. Our museum has during the year emerged from its chaotic condition into a state of order and efficiency; a result due not only to the munificence of Mr. Rankin, but no less also to the personal care and interest which he devotes to it.

The first field meeting of the year took place on Tuesday, May 23, at Stoke Edith, for the Woolhope Valley. On arrival here the business of the club was transacted. The members then proceeded to Purton, on the way meeting with Dr. Grindrod, who furnished the party with much information as to the palæontology of the neighbourhood. At Purton, a quarry of Upper Ludlow and Aymestry Limestone was visited, in which many of its characteristic fossils were seen, but no rarities were met with. The section of Upper Ludlow in the lane was noted, and considerable attention was given to the section at the bottom of the lane, where the passage beds between the Upper Ludlow and Downton sandstone is exposed. The bone bed is here represented by a stratum containing bits of carbon, pachytheca, &c., but few, if any, fish bones. Previous investigation had largely removed the most accessible portions of this bed, so that the party were unable to do more than fully identify it; the more so as time was short and return had to be made at once to Stoke Edith Gardens to meet the Dudley Club. Seager Hill was then ascended, and the topography of the valley studied. After dinner we were favoured with a good paper on the Clear-winged Sphinges of the district, by Dr. Wood, of Tarrington. The district, under Dr. Wood's sharp research,

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proves to be so rich in some of the rarer forms of insect life that I hope he will shortly redeem his promise of giving us a more extended paper on the entomological fauna of Woolhope, when he will no doubt point out to us how it happens that the varied geological formations, the alternation of hill and vale, and the diversified surface, favour the existence of species that are rare or wanting in the more level districts of the county where the Old Red prevails.

In the various references to the geology of our primeval home which occur in our transactions, there is always more or less implied, sometimes very distinctly stated, a catastophic theory of its formation which I think must be even in excess of that at any time held by Sir Roderick Murchison himself, whose views especially favour that theory, no doubt, and any of whose opinions must meet with an almost superstitious respect throughout the Silurian kingdoms. Such an exaggerated form of the theory is no doubt due to the exigencies of our existence as a field club. Such accounts of the physical history of the Valley of Woolhope as we have, necessarily compress its events into a brief outline, and bring most clearly of all before the imagination the immense amount of dendation that has taken place. Speaking of the Woolhope Valley, Sir Roderick himself says, "What agency, I ask, except that of very powerful currents of water, could have removed every fragment of the *debris* that must have resulted, whether at one or several periods of elevation, from the destruction of all the superposed arches of rock, and have scooped out all the detritus arising from such destruction, from the circling depressions, the central dome, flanking ridges, and former cover of those Silurian strata?" So far all may agree; at least if ice be included when water only is mentioned, and if periods of elevation be understood to be more or less long-continued periods, and not comparatively momentary epochs. But when he continues: "And if that water had not been impelled with great force, caused by sudden uprises of these rocks from beneath the Old Red Sandstone, what other agency will account for so complete a denudation, the broken materials having only found issue by one lateral gorge, which was, we see, opened out by a great transverse fracture of the encircling ridges" (Siluria, p. 492—20th edition).

Any attempt to form a clear idea of the hypothesis implied must convince us of its impossibility, I had almost said absurdity. There has been a great upheaval of the earth's crust at the Woolhope Valley, and how rapidly it took place, we shall probably never know. But endeavour to imagine an upheaval so sudden and violent as is implied in the extract I have just quoted. Suppose the district to be submerged under any depth of water you think will produce the greatest effect, and it is very probable that since the Old Red epoch this district has lain under perhaps 2,000 feet of water. Your upheaval is by hypothesis at the site of the Woolhope Valley: now this will not produce violent currents at that place; the violent currents will be all around, radiating from the site of the upheaval as a centre; the denudation will be not of the valley itself but of the surrounding circle, a subsidence would bring a return current, and would pile up debris at the site where we wish to explain denudation. Any repetition of sudden upheavals and subsidences would bring us no further.

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A great point is made of the complete removal of the debris, but this appears to be one of the strongest evidences against any sudden removal by violent current caused by upheaval. Debris removed by such currents would not be entirely removed, and whatever was entirely removed from the immediate site of the Woolhope valley would be found at no great distance in immense and irregular piles. Where are they? If it is suggested that such collections of debris have since been removed by the ordinary processes of denudation, the answer of course is that ordinary processes of denudation could equally have removed them from the Woolhope valley itself. These sudden upheavals and subsidences of a character sufficiently violent to produce currents of water capable of removing absolutely and completely so many million tons of debris, must also have shaken into absolute confusion all the strata to a great depth not only at the Woolhope valley itself but for many miles around. This we know is very far from being the case, indeed the most notable feature of the valley is the very orderly and undisturbed position of the strata, so much so that after full allowance for the several considerable faults that exist, for the dicing up of the rocks by the various lines of cleavage, which are not markedly in excess here over other less disturbed districts, one is filled with admiration at the very slight disturbance of the strata which has been caused by their being raised up into an arch of one mile in height; this consideration forces one to the conclusion that the upheaval was of a slow and majestic character, and that it was not accomplished with much tossing violently up and down, like a terrier at a rat or a housemaid shaking a duster.

But why must the Woolhope Valley especially require such violent processes to account for its denudation? Why must the processes there be different from and more violent than those which operated where we now are? The reason appears to be that at Woolhope we know that strata to the thickness of say one mile—though I cannot myself make the removed strata much exceed half-a-mile by the most liberal calculations—have been removed, while we are, or choose to suppose that we are, in ignorance of the amount of denudation that has taken place at Hereford, and assume it to be but trifling. But when we consider the certainty that an immense thickness of Old Red Sandstone has been removed from here, that it is very probable that the mountain limestone once extended entirely across this site, and that possibly still higher strata did so, we cannot safely give the amount of denudation—denudation as complete as at Woolhope—at less than one mile. Now if we add this to the known denudation at Woolhope, taken as in round numbers also a mile, we get two miles as the denudation at Woolhope to compare with one mile of denudation at Hereford. This is only a difference of 2 to 1—I believe the true ratio is certainly not greater than 3 to 2; but let it if you will be 5 to 1 or 10 to 1. We are again, I think, forced irresistibly to the conclusion that there can, if this be so, be no possible ground for assuming denuding agencies in the one case differing in kind from those in the other.

If we assume, what I have already shown good grounds for assuming, that the rise of the arch, at Woolhope, was slow and gradual, and even if we assume that it rose with considerable rapidity at a remote epoch, we can see that it would

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always be submitted to the much more intense action of denuding agencies of any kind than the lower lying district of Hereford. At the present moment, for example, denudation of the primæval rocks of the Woolhope district is most actively going on. At Hereford they are, and have for the last geological age at least, been buried beneath a protecting layer of river gravel and post tertiary deposits.

I take it that we know very little of how the great mass of this denudation occurred, or when; that the sea had a share in it we may suspect, that ice had much to do with it there can be no doubt—and we know that river agency has been very powerful. But of the former chapters of the history we know little except that there were such chapters; of some of the last chapters there are many more or less distinct but fragmentary records. At considerable elevations on the flanks of the Wye valley are deposits of river gravel, such as could only have been deposited by considerable streams, probably by the Wye itself. By saying the Wye, I do not wish to insist that the watersheds were at those dates precisely the same as at present, but that a large river passed down the valley past Hereford, as at present, admits of little question. Since the date of the higher and earlier, at least, of these gravels, there is considerable evidence that a minor glacial period occurred. But the chief interest of these gravels in the present connection is the proof they afford, that at a geologically recent date the Wye flowed at a level sufficiently elevated for it to have entered and swept round the Woolhope valley—and there exist deposits of gravel and drift in the Woolhope valley itself to attest that this was very probably the case. Look, again, to the lower part of the Wye—at the Wye between Ross and Chepstow. Ask what was the level of the Wye at Mordiford before those deep and picturesque gorges were cut through? Will not the answer again be, that it was sufficiently high to have swept the Woolhope valley?

The inner slope of the outer ridge of the Woolhope Valley is obviously formed of talus, due to the subaerial destruction of a cliff or rock wall; and at Adam's Rocks we have still remaining a portion of the cliff not yet entirely lost in the accumulating *debris* formed by its own destruction. I think it is not by any means an abuse of the scientific imagination to picture these cliffs, perhaps not entirely formed—for probably much denudation had previously been accomplished—but having their precipitous faces renewed by the rushing waters of the Wye flowing past their bases, at that remote date—however recent the geologist may consider it—when the bed of the Wye was many feet above its present level.

Probably the modern geologist will smile at my remarks, and suggest that no one now does fully accept the catastrophic theory. I can only say that our transactions show that we still largely accept it to explain the denudation of the Woolhope Valley. I am no geologist, and may have fallen into various errors in what I have said relating to the processes by which the Woolhope Valley has been formed. But I have thought it well to take this opportunity of asserting that the Woolhope Club, as a body (or at least I myself as a member of it), do not adhere to the belief that the complicated appearances we observe are to be

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explained by demanding that they be produced more or less off-hand by some violent agency, of whose existence there is next to no evidence; whilst more or less completely overlooking these more poweful, if less swift, forces of nature which we see constantly in action; and especially to call attention to the evidence we have that much of the sculpturing of the Woolhope Valley, with not a little denudation, has been done by the river Wye, during and since the last glacial period. If we bear in mind Mr. Croll's hypothesis—I had almost said demonstration—that the glacial period was really a succession of alternations of glacial cold and perpetual spring, accompanied by variations in the sea-level, we can understand that denudation during that period progressed with much greater rapidity than at present.

The second field meeting of the year took place on June 27th, when Llanthony Abbey was visited; the weather was too propitious, the thermometer indicating 80deg. in the shade. Thus ladies, for this was the ladies' day, and members whose tastes were archæological, and who sought the shelter of the ruined abbey, in preference to more extended researches, no doubt found its cool shades more pleasant than the intense heat of the sun in the narrow valley of the Honddu. I only heard of one member of the Club who succeeded in reaching the travertine deposit, with its botanical treasures, which was marked as the limit of the day's excursion, but not a few visited the ancient yew trees in the churchyard of Capel-y-ffin, and several clerical members made some praiseworthy, but rather unsuccessful efforts, to study the natural history of their cowled brethren in the neighbouring monastery. When the party were again gathered at the Abbey, W. Blashill, Esq., read a paper on the abbey, giving not only its history, but fully explaining the various portions of the ruins, their dates and former purposes, which, so much has time altered and destroyed them, are not immediately obvious to the ordinary observer. The other paper for the day, by Dr. M'Cullough, was on the Old Red Sandstone deposits of the district, illustrated by many valuable and interesting fossils from neighbouring quarries and by the hills and bold escarpments of the surrounding valley.

The third field meeting was in conjunction with the Caradoc Field Club, to visit Old Radnor and Stanner; I was unable to be present at this meeting, which I understand was in every way successful. I hope the field address, by R. W. Banks, Esq., will appear in our transactions.

On the fourth meeting, on August 25, the Club went further afield than usual, visiting the Brown Clee Hill. The weather was exceedingly favourable. The British and Roman camps on the summits of Brown Clee, of Nordy Bank, aud of Abdon Burf were visited and inspected, and the account of them given by the Rev. Arthur Clewes, in a short but valuable address, added most materially to the interest with which they were viewed; the hut circles, if hut circles they were, on the summit of the hill, did not meet with a fully satisfactory explanation at the hands of any of the members present. Time did not admit of any of the coal pits which are worked here being investigated. The same reason interfered

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with the completion of Mr. Rankin's valuable and useful paper on the "Formation of Soils," which he read after dinner, but which we shall have in full in our "Transactions." An entomological note of my own was taken as read.

I have already referred to the fungus meeting as having been eminently successful. Its records are fully and pleasantly written by Mr. Worthington G. Smith in the pages of the "Gardeners' Magazine," and if you transfer this to the pages of our transactions, it is mere surplusage for me to give you a meagre *resumé* of the proceedings. I may take this opportunity of acknowledging the liberality of the "Gardeners' Chronicle" and of Mr. W. G. Smith, in providing us with numerous illustrations for our forthcoming volume of transactions; chiefly bearing on the papers which Mr. W. G. Smith has read at our meetings, with several others from his sketches in Herefordshire. There will also adorn the volume some plates of Herefordshire fungi from Dr. Bull's drawings. There has been considerable delay in getting the earlier part of the volume into the printer's hands, but the remainder of the book should progress rapidly. The fruit department of our fungus meeting has been, I need not say ably, reported on by Dr. Hogg in the pages of the "Journal of Horticulture," whence an account of it may be transferred to our columns, so that a detailed account of it now is unnecessary.

The exhibitions of apples and pears show a marked advance on the very successful show of the previous year, and may now be accepted as an established part of the annual programme of the Club, with every indication of increasing in force and usefulness. A further step has however now been taken in the appointment of a Pomological Committee who are to publish a Herefordshire Pomona. As usual, Dr. Bull is the leading intelligence and active power in this new movement. The active co-operation of Dr. Hogg, who is, I presume, the first pomologist in this country, has been secured, so that there can be no doubt of the success of the forthcoming work. The one thing by which individual members of the Club may promote this success, is by securing as many subscribers as possible; the larger the number of copies ordered the less will be the actual cost of each; and the difference will enable the Committee to materially increase the size of each number. No papers on any pomological subject were communicated to the club, though not a little valuable material cropped up in various conversational discussions. Much was said on the question of the dying out of old varieties, though I fear the question was not materially advanced in any way. The subject is one of great interest both practically and scientifically, and I sincerely hope that the Pomological Committee will carefully collect all the facts they can bearing on the subject. Let us know what old sorts have disappeared; how and why they disappeared. What old sorts still exist, and the precise condition in which they are to be found. Let them also, for the benefit of future inquirers, fully describe the present state of fully established varieties that are supposed to be at present at their best. Nor let them omit to leave a trustworthy record of those new sorts, of the date and circumstances of whose origin it may hereafter prove very desirable to have clear evidence. The great want on this subject is not opinions—opinions

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are as plentiful as blackberries; but facts seem unduly scarce; especially do different reporters bring forward most contradictory statements. We are told by one that such an apple has entirely disappeared; a second says, Oh, no, you will find it growing at such a place; a third says, I know the trees you mean, they are not such and such an apple, they are so and so—naming another variety. Such is the ignorance of many growers of the names of their apples, for which they frequently use names given by themselves for their own convenience, that it appears extremely probably that many that are supposed to be extinct would be found to be still cultivated under local names, or under no names at all, were a sufficient search made for them.

The general aspect of the question is as to the longevity of varieties propagated by buds or grafts without the intervention of sexual reproduction. Andrew Knight says "that certain varieties of some species of fruit which have been long cultivated cannot now be made to grow in the same soils and under the same mode of management which was a century ago so perfectly successful," and adds his belief that all attempts to propagate these kinds have been given up in consequence. It would be most desirable to know what is the present state of the individual varieties of which Knight half a century ago reported in these terms. He adopted the theory that the life of no variety, however grafted and budded, would survive the period of existence to which it would have attained if allowed to remain as an individual; and that when the original seedling tree died from natural exhaustion and old age, trees derived from it by grafts, buds, cuttings, or otherwise, likewise disappeared from the same cause. Innumerable instances can be adduced, however, to show that this is certainly not the case; some of them even among apples. Some advocates of the dying out theory, when unable to deny the pressure of these facts, shift their ground a little and take up a fresh position, bringing forward facts that, if established, are of much scientific interest. We cannot deny, they say, that such a sort of apple still grows freely and vigorously when grafted in a suitable manner. But look at the fruit, it is not the same fruit at all—large, succulent, vigorous enough, certainly, but not the same fruit; it is quite lacking in the special qualities that we value in the original kind. If this change is real, and not a mere matter of opinion; if, moreover, it is persistent, and shown not to be due to a different stock being used, and especially not to the mere youth of the younger-grafted trees, it must be taken to show a power of variation of a cumulative character in plants propagated in a non-sexual manner, differing both from graft-hybridism and from the sudden sports that sometimes occur and can be perpetuated by grafting. Our Pomological Committee will produce a work that will, there can be no doubt, be something more than a useful book of reference to the apple grower, or a handsome volume for the drawing-room table, and I hope they will verify for us all the facts they can collect bearing on this subject, not only for our present information but for the use of future investigators. Darwin has recently published another work which indirectly bears on this subject. From the conclusion he arrives at we may think it extremely probable that varieties propagated by buds and grafts only will, in the course of time, die out, but that whilst the time necessary would be shorter

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than that in which a variety propagated by seeds would perish, if, indeed, such a variety would, in the sense intended, perish at all, still, its duration would be so great that we have not yet had time to witness the decay of any variety in this way. This conclusion well accords with the many known instances of plants still vigorous having been propagated by buds or grafts only, for centuries or even thousands of years.

Mr. Darwin's recently published work is "On Cross and self-fertilisation of Plants." Perhaps the strongest impression formed in reading it is not on the subject of the book itself but of its author. One is forcibly reminded of the aphorism that one of the chief characteristics of genius is an infinite capacity for work. The volume is based on numerous carefully conducted experiments, carried out continuously during eleven years. Time would fail me to even briefly summarise the conclusions drawn from these experiments. A measure is given of the amount of advantage derived from cross over self-fertilisation, and many of the conditions that determine the advantage derived from crossing investigated. Why cross fertilisation should be almost a necessity remains, of course, an inscrutable problem, but it is clearly shown that to secure the full advantages that result from a cross, it is necessary that the stocks that are crossed should have existed under somewhat different conditions for some generations. There are, however, several species of plants existing in a state of nature that appear never to be cross fertilised, but have probably for ages been propagated by self-fertilisation. Of these one of the most remarkable is the Ophrys apifera. Still more remarkable, however, is the fact that by artificial selection it appears possible in some species, in which ordinarily cross fertilisation is as necessary as with others, to raise varieties or races of as much or greater vigour than the parent race, in which propagation by self-fertilisation may be continually resorted to without diminution of stamina.

Among other events of the year the Arctic Expedition has brought some additions to our knowledge, but those that are of interest to our club are not of great importance. The northern limit of animal migration in the direction taken by the expedition appears to have been reached, but this limit appears to be determined, not by the fact of higher latitudes being uninhabited, but by the accident that in that particular longitude there is no further extension of land to the north. Another of the events of the past year has been an energetic attempt to stifle scientific research, in obedience no doubt to most praiseworthy motives, but in effect a striking instance of that zeal without knowledge, whose results are not commendable. In the event the common sense of our legislators has so far prevailed that a measure has been passed that will interfere but slightly with the progress of science, whilst it will satisfactorily prevent those abuses in its name that are liable to occur, though in this matter it is known that they were in this country at least but trifling in extent. I refer to the Experiments on Animals Act. The whole question is one to be settled by ordinary common sense—but it must be common sense duly instructed as to the facts. As a major premiss, common sense has long ago decided that pain and even death may be inflicted on

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animals with a view to an adequate benefit to the human race, and these penalties are daily exacted from the animal world for purposes of food, clothing, locomotion, of mere convenience, or even of sport. As a minor premiss we have the comparative importance of the object in view, the majority of people require to be instructed that very few experiments by competent observers involve much pain; that few experimentalists inflict in a year as much pain as say one average sportsman does in a day's shooting; and as to the object in view a scientific education is almost necessary to fully understand that the progress of medical and sanitary knowledge largely depends upon their results, and how closely the advancement of science, on which, what we call modern civilisation is really based, is in some of its most important branches associated with them. I take this opportunity to express my opinion on the subject, as being one personally quite disinterested in the matter, having never made, and having no wish to make such experiments, but who believe myself well fitted by education to form a clear and just estimate of the whole of the facts. The question will no doubt assume a somewhat different aspect when we agree that it is wrong to injure animals in any way. But until this Brahminical doctrine obtains acceptance, no better justification for such injuries can be found than the advancement of medical, sanitary, and physiological science.

Before drawing these imperfect and desultory remarks to a close, I desire to call your attention strongly to our Museum, *i.e.*, to the Museum of the Hereford Free Library and Museum. I would not only ask you to present to it such specimens of natural history—especially those belonging to, or collected in the county of Hereford, that may now be in your possession—but I think we ought individually, and as a club, to specially collect and preserve specimens for it. Duplicates, if of any uncommon species or object, would be almost as acceptable as objects for our own shelves, as they would enable a proper return to be made when other museums are willing to send us from their duplicate drawers, specimens we are in want of. I have already adverted to the small amount of real field work done by the club, and, I might add, the paucity of papers during the past few years; always excepting the mycological department, where, both as regards field-work and papers, there is no lack of energetic vitality. I would suggest that the museum might be made the occasion of some most valuable work; if each member of the club would take in hand some subject, work up its natural history as displayed in the county, and present the results in the form of papers for our club, and specimens for the museum, most valuable results would be attained. The greatest difficulty in the way of carrying out this suggestion, will probably be found in the ambition of individuals—I will not insinuate laziness—I fear that each will endeavour to cover too much ground, to work up, perhaps, the ornithology or the botany of the county. To reach the maximum of usefulness, as well as of success, the object of research cannot well be too limited and defined—a small group of animals or plants, or even one species will, if fully observed and illustrated, present abundant material for a year's work, and, what is so important, the work becomes readily manageable—so much is the history of every species linked with

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that of many others, that a research even so defined requires to be repressed within its own limits with some severity to prevent its branching and extending indefinitely. The choice of a subject of observation by each member would be determined by his opportunities and special likings, and there is no reason, if opportunity serves, why he should not be advancing two or more subjects at the same time. Arising out of this I am tempted to allude to the fact, that so far as the volumes of the Club's proceedings show, there are still large groups that have received absolutely no notice from the Club; so that the distinguished foreigner, say the scientific *attaché* to the Chinese embassy, might reasonably conclude that Herefordshire was remaraable for containing no mosses or lichens, very few bees, no diptera, neuroptera, hemiptera, or orthoptera, no land or fresh water shells, and of many smaller groups that they were conspicuous by their absence. There is surely here an abundant field even for those who are most diffident of their own powers of observation, or who are most deficient in the necessary leisure.

It only remains to me to thank you for your kindness and forbearance to my many shortcomings as your President, and to wish you all prosperity and success in your future campaigns.

POMOLOGY HISTORICALLY CONSIDERED.

By Rev. C. H. Bulmer.

Among the many subjects important to the country at large, and our county in particular, I can think of none more worthy of encouragement than the study of Pomology at the hands of so scientific and popular a society as the Woolhope Field Club; whether that subject be enterprised from a literary or scientific, from a recreative or commercial point of view.

I hardly know how I come to be reading a paper on this, or, indeed, on any subject. Your President asked me to do so, and in a weak moment I consented. But this I do know, that I have always taken a lively interest in all relating to the culture of the apple and pear (the restricted sense, I may hear mention, the Pomology of my paper bears), and, although the slight information that I can give, will be found both superficial and uninteresting when compared with the knowledge, doubtless, of many who are honouring me with their attention, and whose humility I might, perhaps, have done well to imitate, still, it shall be my honest endeavour, as the best recompense I can make for so great a trial of patience, to supply them at any rate with copious materials for friendly discussion afterwards.

I have chosen the title of my paper,—"Pomology, historically considered"—to allow full scope for a general sketch of the history, past, present, and future of the apple and pear.

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The early cultivation of the pear especially is of great antiquity, and, not too insist too strongly on the correctness of old Pomological writers, who can trace, they say, no less than 20 varieties, as mentioned by Pliny, and five or six by Virgil, it would appear that the first varieties of both apples and pears were introduced into England from the more equal and temperate climate of the continent, but at what period, so far as I can learn, is not clearly ascertained.

Our earliest information of fruits is gathered from fruiterers' bills, and bills of fare of royal and other sumptuous entertainments, and a curious instance is placed on record so early as Edward I.'s reign, 1292 (to which I shall allude further on). One Harris, a fruiterer, in the reign of Henry VIII., so Evelyn tells us, planted 30 towns in Kent with fruit; and it is hoped, he continues in his usual quaint vein, that others would follow Scudamore's good example (the noble introducer, I may here mention, of our French varieties), and plant the best cider fruit, till the preference of cider, wholesome and more natural, doth quite vanish all other drogues of that nature—a prophecy singularly missing its aim in our day, when beer has become one of the estates of the realm—still, also, must time be allowed to run its course before the classic verse of Phillipps becomes a prosaic fact—

"That Silurian cyder borne,
Should place all tastes, and triumph o'er the vine."

If that stupendous event is ever to take place, most assuredly a very great attention must previously have taken place in the management of our trees and fruits, for Evelyn's account of the year of grace 1706 might very easily be substituted for the present year 1877; or, to again quote his ipsissima verba, "There are already more persons better provided with Fruit than with Directions to use it as they should" when in plentiful years. (I have vividly before me 1875, when in my parish hundreds of bushels of fine apples were absorbed into the ground after Christmas because they could not find a buyer at 3d. a bushel), when in plentiful years, continues Evelyn, so much cider is impaired by ignorant handling and becomes dead and sour that many even surfeit with the blessing. It being rarely seen in most countries, that any remains good to supply the defects of another year. In a scarce and curious tract, headed "Herefordshire Orchards, a Pattern for all England," written anonymously, and said by its author to be the first written on the subject (I have it published in a Pomological work by Richard Bradley, Camb. Professor of Botany, in 1726, or only 20 years after Evelyn wrote his Pomona), we read "that Herefordshire was reputed as the orchard of England. From the greatest persons to the poorest cottager all habitations are encompassed with orchards and gardens, and in most places our hedges are enriched with rows of fruit trees, pears or apples, gennet moyles, or crab trees." Of these the writer adds *en passant*:—"Pears make a weak drink fit only for our hinds, and is generally refused by our gentry as breeding wind in the stomack, yet this drink (till the heat of summer has caught it) is most pleasant to the female palate, having a relish of weak wine mixed with sugar." (I always thought—I may be allowed to add also *en passant*—that ladies liked their tipple sweet and strong, but it seems I am mistaken.) "Few cottagers—yea, very few of our

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wealthiest yeomen—do taste any other drink in the family except at some special festivals twice or thrice a year, and that for variety rather than choice." Well may we of the 19th centary exclaim "Tempora mutantur, nos et mutamur in illis." Many a time—continues the writer—servants when they betake themselves to marriage seek out an acre or two of ground which they find fit for orchards; for this they give fine or double value for years or lives, and thereon they build a cottage and plant an orchard, which is all the wealth they have for themselves and their posterities. I regret to say there is, as in Evelyn's account, a black side to this deliciously primitive sketch of an Herefordshire Arcadia in the beginning of the 17th century; for the writer, as he continues, falls into a strain of moralising well fitted to the present age. "For gardens, we have little encouragement to design more than is necessary for our families, except our River Wye may be made navigable for transportation, and by defect of transportation our store of cyder is become a snare to many who turn God's blessing into wantonness and drunkenness. I wish (the writer concludes) this sore proverb, *Bona terra mala gens* may not belong to us. The Most High has filled us with many blessings; but we fail so much in returning due thanks that we many times turn His blessings into heavy curses, and make His liberal gifts the prevailing curse of our hasty ruin—whereas the Rural Life should, in all reason, be the most humble, tame, and innocent."

I will now, in my retrospective survey, take a glance at the historic apples and pears, which were formerly cultivated in Herefordshire, although most of them are best known nowadays by their varieties. It seems to me I can most practically thus treat my subject, because I thoroughly endorse Andrew Knight's remark, though contrary I am aware to the opinion of the best old Pomological writers, that "Herefordshire is not so much indebted to its soil, as to some valuable varieties." And in commenting on these varieties *seriatim*, I shall be able to show you further, that there is also great truth in another remark of Andrew Knight's "that from the description that Parkinson (who wrote in 1629) has given of the apples cultivated in his time, it is evident that many of those known by the same name are quite different, and probably new varieties; some being so altered for better or worse, as to assume quite a new seasonal or structural character. Among cider apples, to which these remarks specially apply, the Redstreak or Scudamore Crab then reigned supreme; the early-fruiting Gennet Moyle, its hardly formidable rival except with the ladies, both varieties long years ago overtaken and swept away by the tide of time; the Musk and Golden Pippin, pigmy anatomies of their former selves, while the Foxwhelp and Styre in a moribund state are only existing on their past reputation, which their numerous progeny unfortunately does not in any degree give promise of sustaining.

I will take first some of our historic Perry pears, on account of their extreme longevity, and from being so well known to us all. The Teignton Squash is first in point of excellence, if not of antiquity, having existed without doubt at the beginning of the 16th century. Its origin is obscure. Although in the last stage of debility and decay the old trees bear well, though disappearing fast.

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The growth of the Teignton Squash resembles very closely that of the Longland, a variety which is still flourishing, and of all pears I should call the farmer's friend, as its fruit keeps fairly and makes very good perry, while to the housewife, nothing can exceed it as a stewing pear in richness and colour, before the Catillac and other late stewing pears come into season. The Oldfield, however, is the best pear we have, whether its fecundity, or the lasting qualities of its fruit or perry is considered. Evelyn mentions in his day (1706) a gentleman who had some bottles of Oldfield perry brought him from a distance of 800 miles, that was over 40 years old, as rich and high flavoured as ever it was—a perfect Regale, he calls it. I can also endorse Evelyn's eulogism, "Penes auctorem fit fides," as I have tasted some bottled perry from this variety over 40 years old, in perfect condition, made from my own glebe orchard from original trees, I do not hesitate in saying—although in full bearing—that are in their third century. These, however, I regret to say, are isolated facts—the exception not the rule—as the description of Palladius holds good now-a-days as in his times centuries ago that perry, chiefly owing to its irrepressible fermentation, "hyeme durat sed primâ acescit æstate." The most picturesque and popular, without doubt, is the venerable Barland, or Bareland, originally of Bosbury:—the same old lofty-growing trees we see now growing most probably filled the tankard of the Herefordshire farmer and his guests in the 17th century. It is more a sister beverage, a right sort of smoke-a-pipe perry (as an old right-sorted farmer himself described Foxwhelp cyder), than any other. Of dessert sorts of Historic pears, time will only allow of my mentioning two, the Easter Beurrè and Beurré Diel, and to find them a local and special history. These two varieties I have ascertained were shown at our last Pomological Exhibition in far larger quantities than any others, and both in their selection and production reflected great credit on their growers. Looking at the market price of fruit in Covent Garden Market a fortnight back and before the commencement of the London season, I found there two identical pears alone mentioned by name at what must be considered the highly remunerative price of 5s. to 12s. per dozen, while Blenheim and Ribston Pippins (again strange to record), shown at our exhibition both in far greater quantities than any other variety of apples, fetched from 12s. to 18s. per bushel. It is, I believe, well to comment on facts, like these, when in Herefordshire, the Orchard of England, so many tons of first quality fruit are suffered to perish through want of seasonable pruning, sheltering, or picking; or, still more unpardonable neglect of the simplest rules to be observed in subsequent hoarding. Thus, the home counties and Herefordshire, and even some parts of Yorkshire, who, as Phillipps sings, do not disdain to learn—

"How Nature's gifts may be improved by art,"

command a ready market; while Herefordshire, with the finest natural advantages in the world, is obliged perfunctorily to depend upon the impecunious visits of the huckster for the sale for her immense surplus stock of what she has only to thank herself for being, pot-fruit or pit-fruit.

As I must hurry on, I feel, to bring my paper to a close, I will only give you a list of the most celebrated of historic varieties of apples, making a few remarks

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afterwards chiefly as regards the nomenclature and varieties of those oldest, best known, and valued.

The Joanetting or Juneting, the Margaret, the Pomeroy, the Costard, the Winter Quoining or Queening, the Russet or Royal Russet, the Lemon or Quince Pippin, the Golden Pippin, the Nonpareil, the Beefing and the Margil. Among cider fruit the Red Dymock, the Forest Styre, the Royal Wilding, the Red Streak, the Woodcock, and the Foxwhelp. This list includes, I believe, nearly all the old historic varieties— some flourishing, some lingering on to the present day.

The etymology of the Joanetting, or Juneting apple is so singular, and decides the name of so many other apples and pears, that I shall not apologise for selecting it. It is one of the oldest and earliest bearing apples, hence the mistake about its name being June eating, in allusion to its maturity at the end of June or July. Dr. Hogg traces its name to Joanetting, from its apples ripening about St. John's day; for a similar reason the next apple, the Margaret takes its name from St. Margaret's day, July 20th when the apple would be in season.

The Costard is one of our oldest English apples; the variety is actually mentioned by name on a fruiterer's bill, in Edward I's reign, 1292 (as previously alluded to), and although now almost extinct, still used to be so common, that retailers of it (even the very price mentioned at 1s. per 100), were called "Costard-monger," a name in popular use now in the word "Costermonger." Some etymologists (including the great Dr. Johnson) consider the name Costard to be derived from cost a head, but why it is difficult to tell. Dr. Hogg traces the name to Costatus Ang. Costate, or ribbed, on account of the prominent ribs on its sides.

The Quoining or Queening is an old apple of which we have many varieties in Herefordshire (notably the Cowarne Quoining, a most valuable apple) which were excellently and numerously shown at our Pomological exhibition. The name Quoining may be traced by the angularity of the shape of the apple (similarly as in the Costard) from the word coin or quoin—the corner stone of a building.

The Catshead is another very old apple still grown among us, but chiefly I have noticed in cottagers' gardens, where, however, it is gradually giving way, especially in Herefordshire, to the Hawthornden, and Lord Suffield.

Phillipps sings its praises thus,—

"The Catshead, weighty orb,
Enormous in its growth."

The old and Winter Pearmain must by no means be omitted. It is the very oldest historic variety we have. In Bloomfield's "History of Norfolk," as quoted by Hogg, there is curious mention made of a tenure in that county, by petty Sergeantry, and the payment of 200 Pearmains, and 4 hogsheads of cider of Pearmains, into the exchequer at the feast of St. Michael.

The origin of the name is equally curious. In early historical works of the same period Charlemagne is written Charlemaine, the last syllable as Pearmaine, and as Charlemaine was derived from Carolus Magnus, so Pearmaine is derived from Pyrus Magnus, the great Pear Apple, in allusion to its pyriform shape.

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The Lemon or Quince Pippin is mentioned by Ellis in 1744 as so good an apple for all ages that many plant the tree in preference to all others. I know a nurseryman in my neighbourhood who has several trees of this variety in wonderful bearing; but he says he could sell twenty times the quantity he has to different nunneries, where, owing to its brisk and refreshing taste, it is a special favourite.

The Golden Pippin, though of considerable antiquity, has very little early history. It is not the Golden Pippin of John Parkinson, because he speaks of it as a large variety. Evelyn, in his Pomona, states that Lord Clarendon had in his time at his estate in Berkshire an orchard of 1,000 golden and other cider pippins, but no allusion is made to it as a dessert apple.

The Margil is still grown successfully in Herefordshire. It is said to have been originally introduced from Versailles in 1750. This apple was shown very nicely at our late Pomona Exhibition. In delicacy of flavour it is unsurpassed, but unfortunately it is a shy bearer, owing chiefly to its blossoms suffering from frost more than other apples.

The last, though one of the earliest historic apples, I shall mention is the Pomeroy or King's Apple. This apple is of extreme antiquity, but very little is known of its early history. In Hogg's Fruit Manual (a work most judiciously added by Dr. Bull to the Free Library), and from whose descriptions I have largely borrowed, two distinct varieties are mentioned in use nearly at the same time, but differing altogether in shape, flavour, quality, and colour of flesh. I take a particular interest in this old and highly-valuable variety, because in my parish we have three or more very old trees still flourishing, and I was glad to see this apple exceedingly well shown from many parts at our late exhibition.

The original variety of Pomeroy still bears very fine juicy and delicious fruit in September, but which very soon perishes, indeed last year many apples decayed while hanging on the tree.

This undoubtedly would be the Pomeroy of Somerset mentioned by Hogg, though he puts back its season too late from October to December. Now I was shown, and indeed tasted, a fortnight ago a specimen of the second variety, the Pomeroy of Lancashire, which had been bought in the Hereford Christmas market under the pseudonym of the Green Blenheim. This cannot be the true Pomeroy, as this variety does not answer at all to the description given it by the old writers, neither seasonally nor structurally, and I was pleased to find in Forsyth, who wrote his treatise in 1810, that this is only a late variety of the true Pomeroy.

He describes it as the Winter Pomeroy and a good baking apple, and keeping till January. I should say this might be a variety of the true Pomeroy, promiscuously crossed with the Nonpareil or one of its many varieties, as it bears a strong resemblance to that apple.

The most interesting of our cider historic apples, which may be considered as existing now are the Dymock Red, the Royal Wilding, the Cowarne Red, the Skyrmes Kernel, Forest Styre, the Underleaf, the Woodcock, and the Foxwhelp. Of these varieties I will only briefly say that the Dymock Red is either a different

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apple altogether or altered strangely in character. Now it is one of our earliest and best cider fruits in the Ledbury district, while in Forsyth's time, the Dymock Red—similar otherwise in description—kept from January to March.

The Royal Wilding also demands a special notice. It is one of our best cider fruits, and I always thought that Herefordshire had the credit of raising it until undeceived by Dr. Hogg, who claims that honour for Devonshire. Now I find in old Barry Langley so different a plate altogether of the Royal Wilding in his time, to what it is now with us, that I must consider them two distinct varieties of apples, until disproved by seeing a specimen of this fruit in the autumn from Devonshire.

Of the Forest Styre, I have failed in obtaining any history whatever. It is mentioned by the oldest writers, and its praise extolled to the skies when grown on light and chalky soils. It is an early sort, and the strength of its cider immense. I am told grafts from the old trees canker and perish sooner or later, while the cider made now is harsh, and has lost all that charm of flavour for which formerly it was so celebrated.

With the Foxwhelp this is not the case; I mean with the original trees; if fruit only can be got the flavour or gust is most *prononcé*, but from any other trees than the original this flavour is barely perceptible.

With this piece of information I come to a full stop. Evelyn dismisses the Foxwhelp in a single line contemptuously, "as making a cider that requires two or three years to come round." Can I with any sense of self-respect or in common justice, leave to the last and dismiss hurriedly our prince of apples, the sole survivor in the race of time, our highly-flavoured fruit that like Shelley's flower is "dying of its own sweet loveliness," and like the "expiring swan is singing only in its death"? No, we "orchat lords of Herefordshire," as represented by the Woolhope Club, mean to pay the highest tribute in our power and to make its fame immortal by allotting to the Foxwhelp Apple the pride of place, in the first number of our Standard Herefordshire Pomona, while as to my humble self, I will not, I repeat, insult the time-honoured, lichen-sheathed giant by giving him now a beggarly passing notice, but thanking the company for their attention will leave some other brother member the high privilege of reading a special paper in honour of the Foxwhelp, on its longevity, its specific untransferableness, and its unrivalled power in the words of Evelyn (speaking of *all* good cider), "in soberly exhilarating the spirits of us hypochrondriacal islanders."

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SHROVE TUESDAY AND ITS CUSTOMS.

By James Davies, Esq.

As the annual meeting of the Woolhope Naturalists' Field Club falls this year on the day known as Shrove Tuesday, I have, in compliance with a request for that purpose, prepared a few remarks upon the well-known custom of this day, as well as the derivation of its name. I very much fear the subject will be considered by many somewhat puerile for such a learned society, and that it is almost too much to ask the members to leave their lofty speculations on geology, meteorology, botany, natural history, and their associated sciences, and condescend to give a hearing to a few observations on Shrove Tuesday, pancakes, and apple fritters.

As respects the season of Lent, so intimately connected with Shrove Tuesday, we are informed in Echard's History of England that in the year 640 Eadbald was succeeded by his son Ercombert in Kent, who commanded the destroying of idols in his dominions, and was the first king who established the observance of Lent by law and penalty.

But in treating of this subject it must not be supposed that I contemplate any theological remarks on the observance or non-observance of the Quadragesimal Fast, preparatory to the great festival of the Christian Passover, which in the English Liturgy are distinguished by the several names of Lent and Easter—however questionable such ecclesiastical terms may appear—for it is merely my intention to make a few observations of an antiquarian character upon the day known as Shrove Tuesday, and its agreeable prandial association of the pancake.

In the ancient laws and institutions of this island, we find frequent reference to the Quadragesimal Fast of Lent as an important church season, and whoever will take the trouble to glance over "The Ancient Laws and Institutes of England," as well as "The Ancient Laws and Institutes of Wales" published some years ago under the auspices of the Commissioners of Public Records), will find much curious information in connection with the ecclesiastical rites and customs of the times to which those institutes relate.

In the preface to the Laws of Howel Dda, according to the *Dull Gwyncdd*, ie., the *Venedotian* or *North Wales* Code, it is stated that the time when Howel summoned the wise men of the Principality together to examine and deliberate upon their ancient laws was that of Lent, because everyone should be pure at that holy time, and should do no wrong at a time of purity.

The preface to the *Dull Dyfed* or *Dimetian* or *South Wales* Code states that this same King remained with the assembly during the whole of Lent, and that at the termination of Lent he selected twelve of the wisest of the laity, with a most learned scholar, to form and systematise the laws and usages for him and his kingdom perfectly, and the nearest possible to truth and justice.

If we pass over to another section of this Island during the same periods of history—namely, that portion occupied by our Anglo-Saxon ancestors—we shall find in the rites observable with the same Lenten fast the more direct clue to the origin of the word *Shrove-Tuesday*, but whether our forefathers instituted the association of the well-known pancake, or received the custom from earlier ages,

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will be a point for further investigation. It is probable that the custom dates from a more remote antiquity.

As respects the derivation of the term *Shrove*, as distinctive of the day before the Quadragesimal Fast of Lent, it is evident that it has its origin in the Anglo-Saxon word *shrift*, which signified "confession." In the Anglo-Saxon Ecclesiastical Laws there is much mention of it—for instance, in the laws of King Ethelred there is an injunction that every man should keep strictly to his Christianity, and accustom himself frequently to *shrift*. And again, if a corpse was buried out of its proper *shrift district*, soul scot was to be paid to the proper authority to which it belonged. In the laws of Cnut it is prescribed that if a criminal condemned to death desired *scrift spræce*, i.e., confession, it was not to be denied him; and if any one denied him, he was to make "bot" or amends to the King with a hundred and twenty shillings, or otherwise clear himself by showing that he was justified in the refusal.

In the Canons of Edgar there are full directions for *scrift*, both for the guidance of him who shrived and of him who was shriven, as well as the festival tides and fast tides, when it ought to be performed.

In the Anglo-Saxon ecclesiastical institutes it is enjoined that in the week immediately before Lent every one should go to his confession (or *shrift*, as the Anglo-Saxon renders the word), and his confession or *shrift* should so *shrive* or confess him as he then may hear by his deeds what he is to do.

There cannot, therefore, be any doubt that the term *Shrove Tuesday* has been thus derived; and that it simply means *Confession Tuesday*, from the injunction in the institutes of the early church of this country to attend that ministration as a preliminary to the Quadragesimal Fast preparatory to Easter.

In the Canterbury tales of Geoffry Chaucer the term *shrive* frequently occurs, and it would appear to be there used as the technical expression for the rite of confession. *e.g.*, it is enjoined in the Parson's Tale that "thou shalt shrive thee of all thy sinnes to o (one) man, and not parcelmele to o (one) man and parcelmele to another."

Again, in the Friars Tale, the Soumpner, or Apparitor, in alluding to his own unjust demands upon those who came within his jurisdiction (and without which he represents that he could not live) alludes to *shrift*, and to Shrifte Faders, or Father Confessors, in the following lines:—

> What I may gete in counsell prively,
> No manner conscience that have I.
> N'ere min extortion, I might not liven,
> Ne of swich japes wol I not be *shriven*,
> Stomak ne conscience know I non,
> I shrewe these *Shrifte Faders* everich on.

A sarcastic reflection on the Soumpner, as well as the *Shrifte Faders*, which is somewhat characteristic of the writings of Chaucer in exposing the peculiar vices of his own time.

Shrove Tuesday, or *Shrove Tide*, *Fastern's Eve* and *Pancake Tuesday*, as it

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was also called, appears to have been, according to writers on popular antiquities, a general day of confession, and with the previous Monday, also a day of sport and pastime, being deemed by some the last day of Christmas, and celebrated with flags, masques, and other popular amusements. It is stated that on the morning of this day London school boys used to bring game cocks to their masters, and were permitted to amuse themselves with seeing them fight. Another amusement of this day was that of threshing the fat hen, which is done as follows :—According to a notice in Fosbrooke's Encyclopedia of Antiquities, the hen was hung on a man's back, who had also bells hung about him, whilst others, who were blindfolded and had boughs in their hands, chased the man and the hen about some large court or small inclosure. The man who had the hen and bells shifted about as well as he could, whilst those who were blindfolded followed the sound to strike him and his hen. After the amusement was over, the hen was boiled with bacon ; and plenty of pancakes and fritters were added to the entertainment. It is said that lazy or sluttish girls were presented with the first pancake ; which, if they well understood the joke, they of course declined to accept. In Wales, if hens did not lay eggs before Shrove Tuesday, they were threshed by a man, who, if he happened to strike and kill any, was entitled to them for his pains. There were other customs in connection with this day, such as masquerades and processions ; and effigies called holly-boys and ivy-girls (probably the evergreen remains of Christmas) were burned. Playing at football by married and unmarried women, archery, running, leaping, wrestling, and sham fights were also among the accustomed amusements of our ancestors on this day, but which have now happily given way to more rational and enlightened occupations. In Normandy there was a kind of Fraternity of Buffoons, known as Cornards, or Conards, who disguised themselves in grotesque dresses, and performed farces and burlesques in the streets on Shrove Tuesday, and we are informed that men of rank even entered their society. They were masked, and personated allegorical characters, such as Avarice, Revenge, Passion, &c., as well as the more real personages of Pope, Emperors, Kings, and others in authority. Among all the former customs of Shrove Tuesday, the pancake has most notably survived, and, like mince pie and plum pudding at Christmas, will no doubt continue to be handed down as a memorial of past times. The origin of the Shrove Tuesday pancake would appear to be a continuation of the Roman festival of *Fornacalia* on the 18th of February ; which, according to Ovid, were a kind of sacrifices offered before the grinding of corn, and continued in memory of the practice of baking bread on a hearth in the form of flat cakes before the Goddess Fornax invented ovens.

In connection with ancient-mythology there were various festive seasons which were continued, after a similar observance, under the change of religion from Paganism to Christianity, *e.g.*, the 25th of March (our Lady-Day) was the Roman *Hilaria* in honour of the mother of the gods ; whilst December was famous for the feasts of Saturn, the most celebrated of the whole year, when all orders of persons were devoted to mirth and feasting—friends interchanged presents, and masters treated their slaves with special indulgencies. Amongst the Northern

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nations the 24th of December was the winter solstice, when on that and the following day they celebrated the birth (as it were) of the new sun, the 24th being the last of the shortest days; so that we can readily perceive the natural continuity of festive enjoyment when there was a certain amount of apparent correspondence with the several seasons under the old and new religious faith.

In Fosbrooke's Encyclopedia of Antiquities, quoting Danet, the author notes that ovens were invented by the Goddess Fornax, and were at first mere contrivances for roasting wheat before the way of grinding corn and making bread was found out; previously to which, as we well know, bread was made in the form of cakes baked upon the hearth, or flat plates or pans. Ovens, according to Suidas, were invented by the Egyptians; at first they were small, but in process of time larger ones became adopted. The bakehouse became an important appendage to a Roman residence, and the principal families baked their bread at home, at first upon heated stones and afterwards in ovens. The ancient Jews, in common with other Eastern nations, adopted the custom of baking in pans. In Leviticus ii., 5 to 7, we find reference to this mode of baking in the expression, "If thy oblation be a meat offering *baken in a pan;*" and again, "If thy oblation be a meat *baken in the frying pan.*" Parkhurst in his Hebrew lexicon informs us that the Hebrew word *(lebebut) pancakes* is derived from the word *(lebeb)*, which signifies to move or toss up and down; and in illustration quotes the passage, 2nd Sam., xiii., 6 to 8, where, in recording the circumstances of Tamar, the daughter of David, and her brother Amnon, it is said she took the dough or flour and kneaded it, and made cakes, or rather tossed it in his sight, and did bake the cakes, which would mean no other than that she tossed and turned the cakes in the pan during the process of baking.

Dr. Shaw informs us in his travels among the Bedouin Arabs, that their bread was made into thin cakes, baked either on the coals, or else in a shallow earthen vessel like a frying pan, and was the same kind of vessel as mentioned in Leviticus ii. 5.

This account of baking in the East has been noticed by Dr. Pococke, Sir John Chardin, and other Eastern travellers and writers.

Dr. Adam Clarke, in his Commentary on the Bible, quoting Dr. Shaw's Travels, states that some of the Arabians had in their tents stones or copper plates made for the purpose of baking, and that Dr. Pococke had similiarly observed iron hearths used for baking their bread. The Dr. further states that Sir John Chardin described these iron plates as commonly used in Persia, and among the wandering people dwelling in tents, as being the easiest way of baking.

Thus we have, as it were, a connecting link with the pancake of the present day—a lingering illustration of the manners and customs of patriarchal times. The pancake of Shrove Tuesday was known among the Normans under the name of *crespe* or *crupellæ*, and it was made with flour mixed with eggs, and fried in a pan.

The fritter appears to be of latter date. Orange fritters are mentioned by some writers, and there was the apple fritter of the 15th century, known as the

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frytter-pome, which by the way will serve as a connecting link—verbally at least if no farther—between our present subject and that of a more strictly pomological character.

Cakes, in connection with religious ceremonies, are of great antiquity. In the Levitical Law of the Jews we find (Lev. ii. 4) that they were enjoined that if they brought an oblation of a meat offering baken in the oven it should be of unleavened cakes of fine flour mingled with oil, or unleavened wafers anointed with oil; and when this people fell into idolatry in subsequent times, we find the prophet Jeremiah rebuking them, amongst other practices (Jer. vii. 18) that their women kneaded dough to make cakes to the Queen, *i.e.*, the frame or workmanship of heaven, in allusion to the idolatrous adoration of the heavenly bodies which the Jews had copied from their heathen neighbours.

Pliny observes that Numa taught the Romans to offer fruits to the gods, and to make supplication before them, bringing salt cakes and parched corn, as grain in this state was considered most wholesome; and the Romans did not deem grain as pure and proper for divine service that had not been previously parched.

Ovid intimates that these bread offerings originated with agriculture, that when men sowed their fields they dedicated the first fruits of their harvest to Ceres, to whom the ancients attributed the art of agriculture, and in honour of whom they made burnt offerings of corn.

Cakes appear to have been the association of a variety of festive seasons. They were valued among the Classical Ancients in sacrifices, for presents and other rejoicings; and in our own country, in the middle ages, were given away amongst friends, which the Puritans endeavoured to abolish as savouring of a relic of superstition. We have, however, remaining in the present day the twelfth-cake on Epiphany night, the Easter cake, and in Herefordshire and Gloucestershire that so well known as the "mothering" cake on Midlent Sunday, in addition to the more general Shrove Tuesday pancake.

Such was the importance attached to this Shrove Tuesday Pancake festival, that amongst the various kinds of bells in use in early times, as for instance the passing bell for the dead, the curfew bell against fire, the mot bell to assemble the people, and some others, there was the pancake bell, which was rung on Shrove Tuesday to remind of the important prandial custom of that indulgent day, previously to the long and stringent abstinence preparatory to the greater festival at Easter—the most important in the Ecclesiastical Calendar. We may then summarise our remarks thus :—

1. That *Shrove Tuesday* means *Confession Tuesday*, preparatory to the Quadragesimal Fast of Lent.

2. That the Pancake was a continuation in the Church, or rather a transfer and compromise of the earlier pagan custom of the Fornacalia Festival of the Roman Mythology. And now apologising for these rough notes on our subject, I would thank each listener for a patient hearing of these very imperfect remarks on *Shrove Tuesday with its Pancakes and Apple Fritters*.

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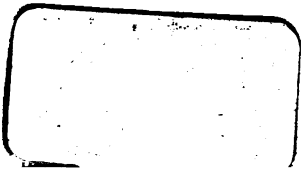

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